

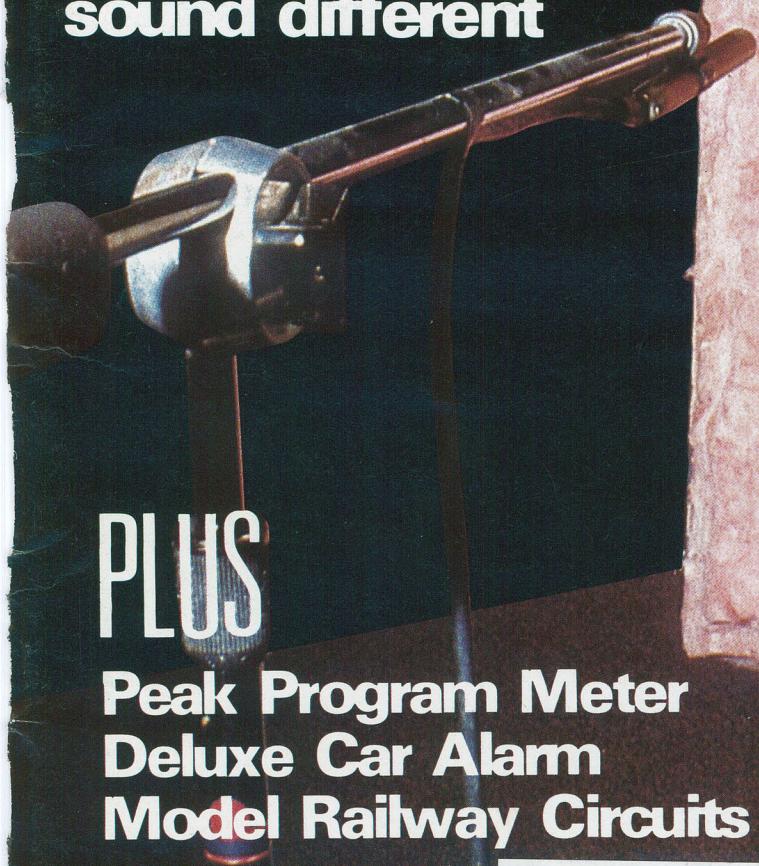
Electronics & Technology Today

Canada's Magazine for High-Tech Discovery

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Periodicity and Perception

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Electronics & Technology Today

Electronics & Technology Today is published 12 times a year by: Moorshead Publications Ltd. 1300 Don Mills Road, North York, Ontario M3B 3M8 (416)445-5600 FAX: (416)445-8149

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Port Moody, B.C. V3H 2J9 (604)939-1432

Newsstand Distribution:
Master Media, Oakville, Ontario

Subscriptions:
\$22.95 (one year), \$37.95 (two years).
Please specify if subscription is new or a
renewal.

Outside Canada (US Dollars). U.S.A. add \$3.00
per year. Other countries add \$5.00 per year.

Postal Information:

Second Class Mail Registration No. 3955.
Mailing address for subscription orders,
undeliverable copies and change of address
notice is:

Electronics & Technology Today
1300 Don Mills Road, North York, Ontario
M3B 3M8.

Printed by:

Heritage Press Ltd., Mississauga, Ontario
ISSN 07038984

Moorshead Publications also publishes PETS
Magazine, Computing Now!, Computers in
Education, Business Computer News and
Government Purchasing Guide.

Circulation independently audited by
MURPHY & MURPHY Chartered
Accountants.

Electronics & Technology Today
is indexed in the Canadian Magazine Index
by Micromedia Ltd.

Back copies are available in microfilm form
from Micromedia Ltd. 158 Pearl Street,
Toronto, Ontario M5H 1L3 (416)593-5211.

Electronics & Technology Today

Canada's Magazine for High-tech Discovery

Volume 12, Number 12

December 1988

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Dell 220 AT Computer

**Imagine an AT compatible
that runs at the speed of a 386.**

STEVE RIMMER



Flakey PC compatible computers have become so much a part of our lives that it's a bit unsettling to come across anything else. When I first saw the Dell system 220 I thought it had just beamed down from Mars and was due to dissolve during the next eclipse.

If you've encountered some of the amazing fly by night computer companies that have turned up of late, Dell will blow you away. Their machines aren't really expensive, their technology is top drawer and their support will impair your mind. Having checked out the hardware from Dell it's seriously unlikely that any sentient being would consider a machine from any other manufacturer.

Clone dealers of the universe... beware...

Farmer in the Dell

As the legend goes, Dell Computer Corporation was started by one Michael Dell of Austin, Texas four years ago. He's now twenty three years old and rather rich. Sickening, this...

Dell's computers aren't really different from any of the other compatible systems about... at least, architecturally. Rather than dangling out on the leading edge, Dell's machines are for the most part well proven designs with everything done right. You'd have to work hard at being dissatisfied with one.

The System 220 is an AT compatible machine running at a blinding twenty megahertz. It turns in a Norton index of 22... the same as the Samsung S800 80386 based machine reviewed elsewhere in this magazine. It's the tiniest desk top AT I've ever come across, being about the size of some monitor stands or uninterruptable power supplies. It has three free slots despite its diminutive proportions, though.

The System 220 comes with a built-in VGA card, as well as two serial ports and one parallel port. It has space for two 3 1/2" inch microfloppies and anything up to 322 megabytes of hard drive space. Its size does not allow for an internal 5 1/4" driver, but they're available as external boxes. You can also get an external 40 megabyte tape streamer.

The System 220 has provision for an optional 80287 math coprocessor. It uses a Phoenix BIOS for the last word in software compatibility. It will run DOS and OS/2, which we'll get to.

One of the best features of the System 220 is not apparent when you uncrate it. It comes with a one year on-site service

agreement. If it does anything untoward in that time, you can call a toll free number, talk to a technician at Dell and, if the machine can't be reasoned with, a service person from Honeywell Bull will come right to your space and subdue the beast. Honeywell Bull has offices all across Canada, and they'll usually be able to put your wayward machine to rights within 24 hours.

In addition to this, if you buy the machine and are offended by the case colour or decide you really wanted a Cray after all, Dell will refund your money within 30 days.

Finally, you don't even have to go anywhere to get a System 220. Dell has no dealers. There's another toll free number to their offices in Richmond Hill to buy stuff though. You can talk to them, work up a system that suits you, they'll assemble it, burn it in and blast it right to your door.

This has to be an improvement over talking to a computer salesman who's still a bit mystified about why you can't see colour cartoons on any of the monitors in the store.

The System 220 I got to play with included both DOS and OS/2; when the machine boots up, you can choose which one you want to run with. It had a big hard drive and a colour monitor attached to its VGA card. The System 220 can be had with either a colour or monochrome VGA tube; the colour is worth what its costs. VGA colour is cosmic.

The microfloppies are a bit of nuisance if you have a lot of conventional 5 1/4" inch floppies kicking about, and if you're upgrading from a lesser machine you'll probably want to spring for one of the outboard drives. However, the small disks do have a lot to be said for them. They store more data, almost a megabyte and a half, and they're rugged.

My test system also came with a mouse. It was a somewhat unusual rodent, being a Microsoft compatible LogiMouse with only two buttons. It worked well, though, and all the applications I tried with it moused without complaint.

The System 220 comes stuffed with a megabyte of memory on its motherboard, but only the first 640 kilobytes are useful for anything. You can actually cheat on this and scoop another half segment in some screen modes if you really have to. Beyond this, however, its motherboard can support up to eight megabytes of memory on board, and up to sixteen megabytes in total.

The System 220 comes with an 85

watt power supply, which seems exceedingly meagre. However, in the time that I used it, it never seemed to have any power supply problems. It might well be that, having used first class parts throughout the machine, the designers of the System 220 didn't need any additional juice.

OS for the Goose, OS for the Gander

As I noted before, the machine which I reviewed came set up to boot into either OS/2 or DOS. You can buy either or both operating systems when you order the machine.

I didn't run much under OS/2 because there's very little common software that uses it. The DOS compatibility window of OS/2 proved interesting. Among other things, you can't run Microsoft Windows in the DOS window of Microsoft's OS/2. OS/2 takes exception to software which meddles with the vector table, which Windows most assuredly does.

Back in DOS, absolutely everything I tried on the system, including Windows, ran flawlessly, and blindingly fast. This included the usual staples like WordStar, long standing nasties like Personal Composer and several arcade games that just live to misbehave on less than fully compatible machines. The System 220 acquitted itself brilliantly.

One of the potential drawbacks for anyone considering the System 220 is its keyboard, which emulates the latest IBM standard. This is a one hundred and one key effort with a number of commonly used keys in peculiar places. The caps lock key is where Control usually is, for example. Control is where Alt used to be and so on. There's a separate cursor mover keypad to the right of the usual alphabetic keys... which is handy, as the keyboard comes up with the NumLock flag set, so that the usual cursor mover keys start off by emitting numbers until you notice this and belt the NumLock key.

If you're new to computers, and will have to learn a new keyboard anyway, this will hardly bother you. If you've used a PC before, it'll drive you half mad for a while. Unfortunately, the System 220 uses a non-standard keyboard connector, so you can't simply swap its default keyboard for one you can get along with more readily.

The keyboard is, admittedly, a minor nuisance at worst.

There are other aspects of the System 220's hardware which are pretty slick. For example, the keylock up front actually locks the case closed, as well as disabling

the machine, meaning that it can't be defeated by simply uncasing the beast and jumpering it. The three available expansion slots all support 16-bit cards. The keyboard nests under the front lip of the case, which looks pretty and saves an inch or two of desk space.

The machine also comes with an extensive set of diagnostics, called the Dell System Analyser. While this is ostensibly to let the Dell service department have an initial shot at troubleshooting your machine over the phone, it's handy in its own right for deciding whether you have machine problems or your own software problems should you encounter something unexpected.

Considering the really fine hardware and software which comprises the System 220, it would have been forgivable had the documentation for the system been a bit thin. This turns out not to be the case. I usually read the manuals last; when I finally got around to these I was most impressed. In the case of the Microsoft based manuals, they're pretty well reworkings of the usual GWBASIC and DOS guides. However, there is an equally competent user guide produced by Dell specifically for the System 220. The manuals deal with everything from booting the machine for the first time to adding a hard drive.

Lastly

After a while, the process of reviewing computers gets one a bit cynical... or perhaps just cautious. Considering some of the machines that have crossed my desk of late, I've felt quite positive toward them if they didn't detonate when I plugged them in.

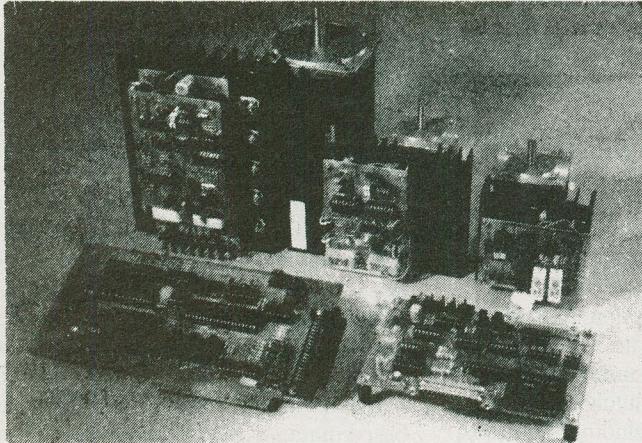
It has been a very long time indeed since I encountered a machine as well built and well supported as the Dell System 220. It's worth three of whatever comes second. There's nothing I can think of to hold against it, and I'd recommend it to anyone who wanted an AT with its capabilities.

Of course, the bottom line is the bottom line... the one drawn against the edge of your Visa card. The Dell machines, with all their bells and whistles, seem to price out within a few hundred bucks of even the most volatile far Eastern clones. I can see no reason to even think about an imported machine with these systems available... unless you like the smell of burning fiberglass.

Even at that, there are cheaper ways to obtain it. ■

MARKET PLACE

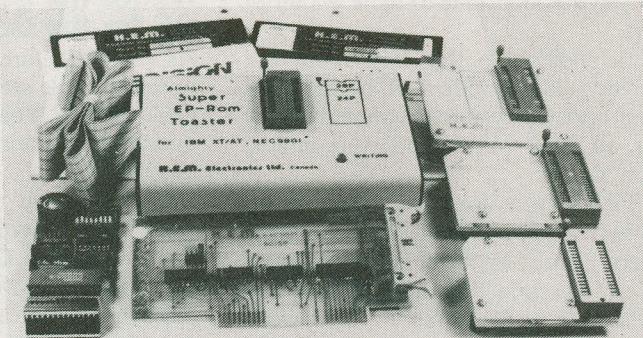
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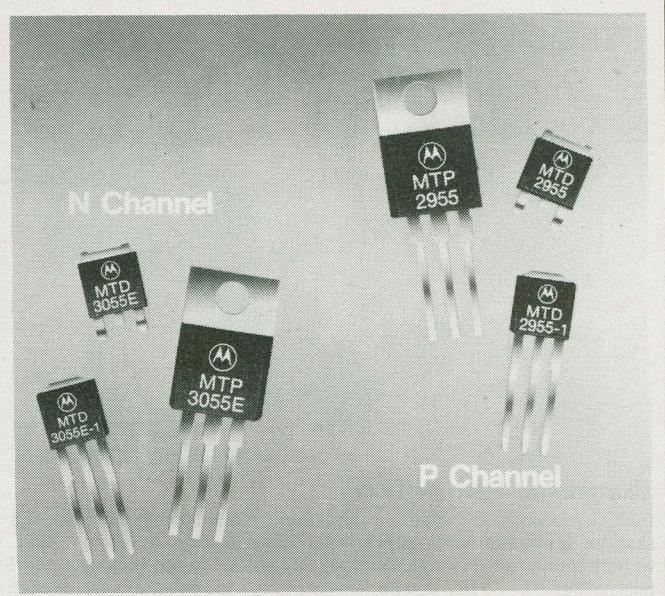
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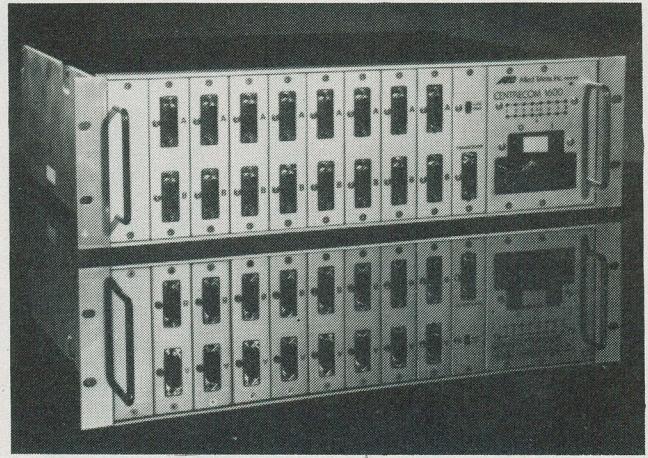
NEW PRODUCTS



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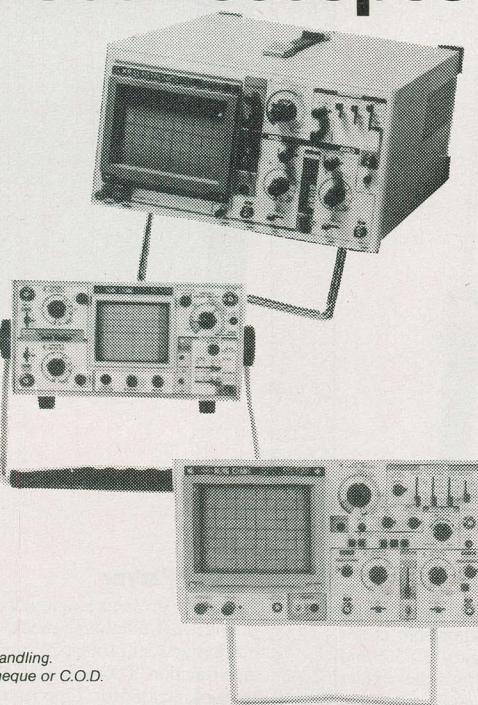
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Circle No. 7 on Reader Service Card

Periodicity and Perception

Why speakers with identical specifications sound different

BILL MARKWICK

The usual methods of speaker testing yield a mystery, one that you're certain to have come across in the hi-fi press: if two similar speakers from different manufacturers have identical distortion, tone burst and frequency response specifications, why does each speaker have a unique sound? Writers struggle to describe these differences, coming up with such terms as strident, veiled, or muddy in an attempt to capture the subtleties of sound.

One term that seems to work is "transparent". The accepted meaning is that a transparent speaker adds nothing of its own to the sound, producing natural audio that just seems to come out of thin air. In the early years of the hi-fi boom, this was usually described as "an orchestra actually playing in your living room", an elusive goal for all but the best of systems. A speaker which is not transparent immediately tells you that you're listening to the music through a machine, and this is true whether or not the speaker does well in the standard tests.

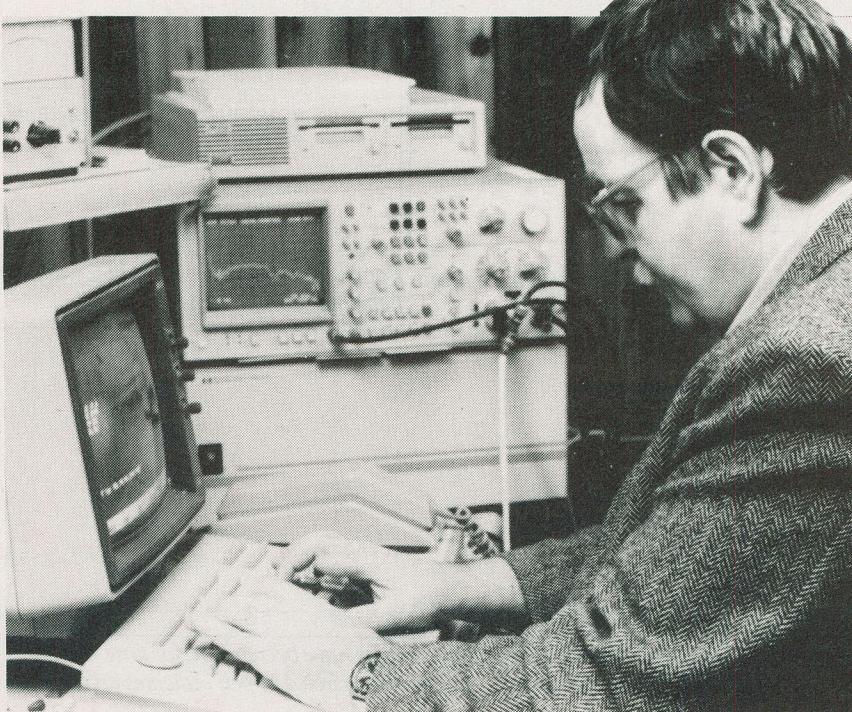
Standard Testing

Before the advent of affordable computer-controlled test gear, there were a number of methods used to quantify speaker response, and despite hi-tech advances in equipment, they remain the mainstay. The most popular, and one that gives a great deal of information, is the frequency response test. A calibrated microphone is used to measure the output from the speaker as it is swept over the audio fre-

quency range. Unless you have an anechoic chamber which prevents any reflected sound, this test is plagued with the peaks and dips of the room response itself. Some of the ways around this include the averaging of several tests from different directions and the use of rapidly swept frequencies to avoid stimulating room resonances.

Testers soon realized that steady-state frequency response wasn't telling the whole story, and the tone burst test was used in an attempt to measure the speaker's ability to respond quickly without overshoot; the test frequency is switched on and off rapidly, letting through a desired number of cycles. The difficulty comes in trying to interpret the imperfect tone burst which is picked up by the microphone. Sometimes the results have no apparent connection with the perceived sound.

Distortion seems to be an important



Mike Wright in the Richmond Hill, Ont. lab and sound room.

parameter, measured with the usual notch filter or with a spectrum analyzer that can sum the value of the harmonics, but again, the difficulty lies in trying to explain why a speaker with high distortion sounds better than one with impeccable specifications.

Adding to the technical difficulty is the processing of the sound by the listener, a subjective variable which we'll come to in a later section.

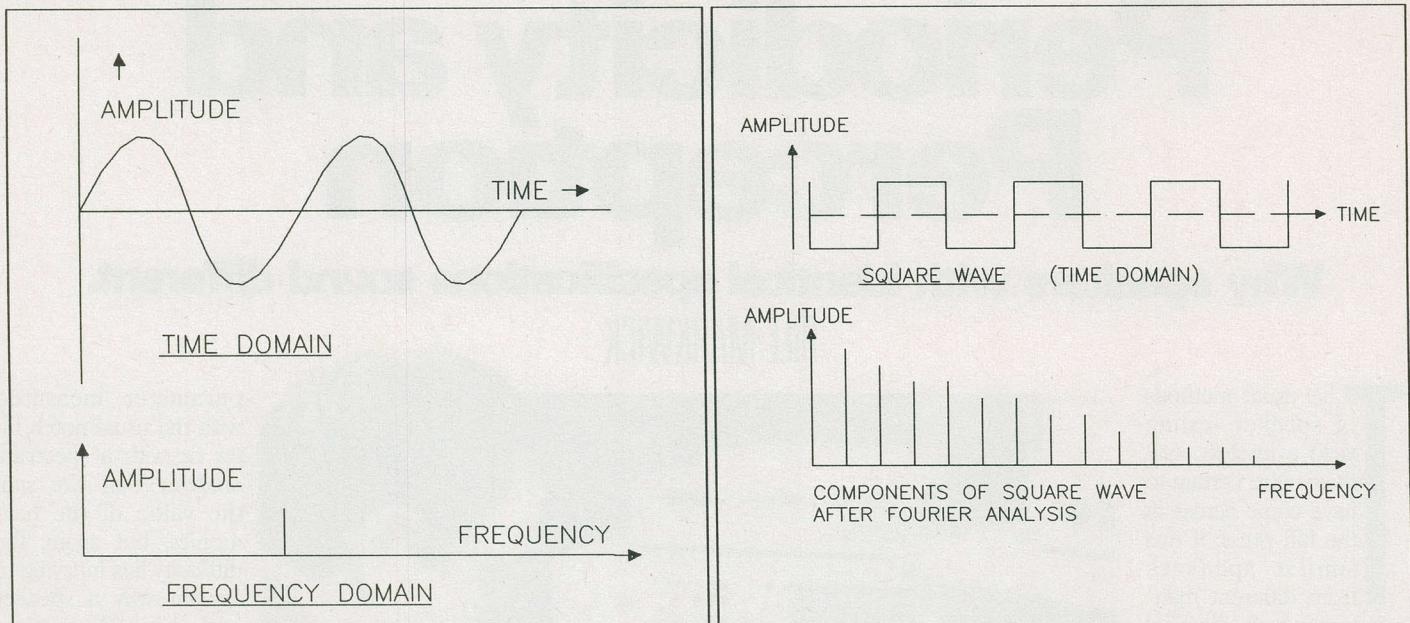
Periodicity

In the mid-1970s, Bell Laboratories published papers on the use of the Fourier transform in sound analysis. The Fourier analysis is a

mathematical tool used to find the various components that make up a complex waveform; a spectrum analyzer displaying the harmonics of a sound is doing a Fast Fourier Transform (FFT). By doing another transform on the new-found components, you can find the *periodicity*; such anomalies as reflections or speaker shortcomings show up clearly.

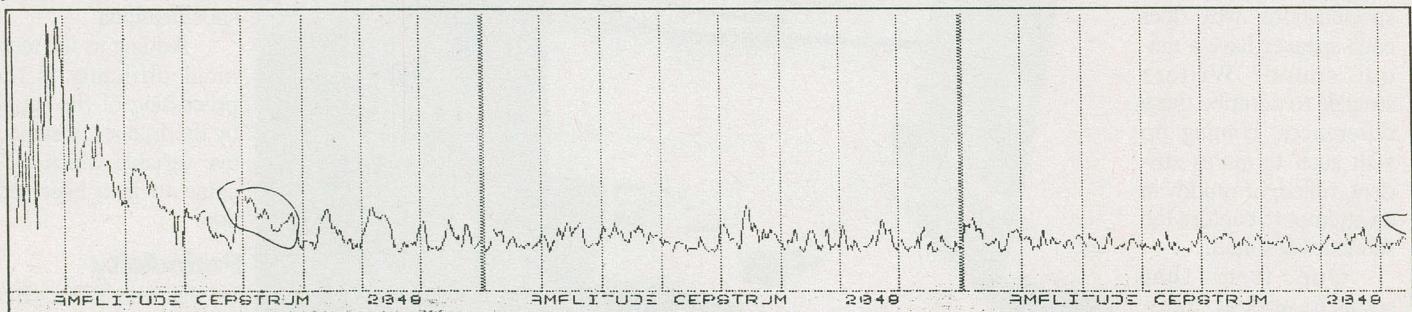
The method of analysis was used to analyze the noise signature from Concorde jet engines; previously, the tests had been affected by sound reflections from the runway, but the periodicity tests allowed engineers to separate pure engine noise from the total sound. The method was later used by Brüel & Kjaer in their industrial failure-prediction equipment to separate undesired machinery noise from the total sound, allowing detection of impending faults without the necessity of shutdown.

Periodicity and Perception

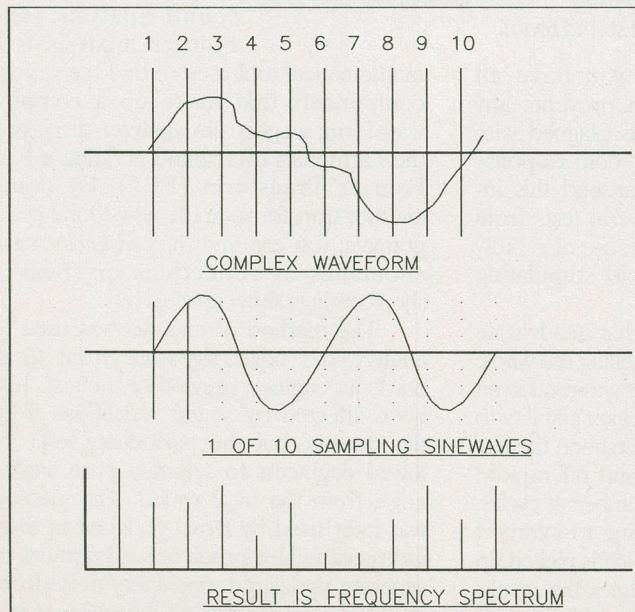


Fourier analysis deals with the frequency domain rather than the more familiar time domain.

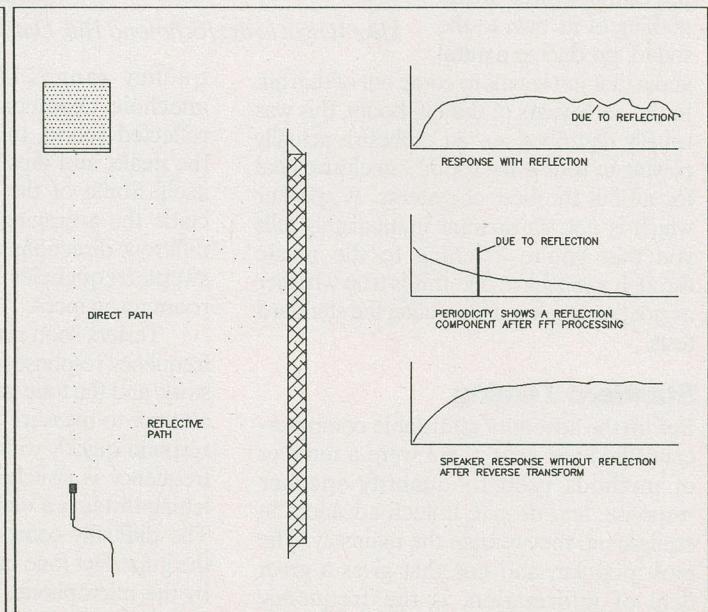
Fourier analysis allows complex waveforms to be separated into their frequency components.



Part of a cepstrum response plot of a Dayton Wright speaker. 2048 samples have been taken for time constants from .5 to 133 milliseconds. The large spikes at the right indicate room response, and the area circled in pen indicates an anomaly.



The sampling sinewave is multiplied by the element in each window of the sampled waveform, and is then repeated at a higher frequency.



Because of differences in the two pathlengths, the periodicity will have a component due to the reflection.

Here in Canada, the method was adapted to speaker analysis by Mike Wright, developer of the Dayton Wright loudspeakers and Stabilant 22, a liquid semiconductor used as a contact enhancer (see the review in our October issue). Periodicity testing offered the possibility of easy removal of room effects from a response plot, as well as the detection of unwanted reflections from the speaker construction itself.

Perceptions

One year during a large trade show, Mike noticed that his awareness of speaker quality was seriously affected by the noise and associated fatigue of maintaining the display booth. Speakers which had previously sounded fine were becoming a chore to listen to, a phenomenon which was easily interpreted as the brain's reluctance to accept any more input.

However, that night he went to a symphony concert and discovered that the live sound had none of the expected shortcomings. The conclusion he arrived at was that all speakers were introducing small oddities of their own, anomalies that the brain filtered out. This extremely complex filtering allows you to listen to desired sounds in the middle of a noisy party, and lack of it is why tape recordings of that party will later sound incredibly cluttered and jumbled, since the required important information (phase relationships, visual cues, etc) is not present.

The periodicity tests seemed like the best way to analyze speaker output and find whatever faults were occupying so much of the brain's audio processing.

Testing

The present test setup in the Richmond Hill plant consists of a soundproof room which is finished inside to represent a typical listening environment, and even includes easy chairs. A calibrated AKG microphone picks up the speaker output, which is a swept-frequency pulse train. The signals are processed by a Hewlett-Packard spectrum analyzer can be displayed on its CRT as a standard frequency response plot, or as a spectrum of components (using the FFT). It also has a 16-bit output which is captured by an HP 68000-based computer.

The software, which consists of 17,000 lines in HP Basic, can then process the information to plot response, phase, and periodicity (the advantage in the spectrum analyzer lies in its speed—the computer takes much longer to derive the FFT).

When Bell Labs published their ideas on using Fourier analysis, someone whimsically labelled the various parameters using anagrams of familiar terms, and so the periodicity chart, which looks something like a frequency spectrum, becomes a *cepstrum*. The periodicity is formally defined as the inverse FFT of the log power spectrum of the components of the sound, and the cepstrum is a plot of the ripple in a waveform for each time constant of the components causing the ripple.

For instance, if the cepstrum reveals a spike with a time constant of about 2ms, then some two surfaces in the speaker environment are causing a reflection, and they'll be about 2 feet apart (taking the velocity of sound as 1ft/ms). As to why this information is not revealed in standard speaker testing: the information is there, but the test format may not be ideal for displaying it, just as a scope display of a squarewave gives no hint that it's the sum of a long series of odd harmonics.

The process can be used to detect small reflections in drivers and cabinets. For example, speakers often sound better with the grill cloth removed; it's not just a case of sound absorption by the cloth—reflections from the frame itself can cause audible effects. The speaker on the cover is being tested with a fibreglass pad to eliminate surface effects; in production this would be replaced by acoustical foam, and the speaker is constructed so that there's no frame protruding past the front surface.

Standard speaker testing in combination with periodicity plots allows rapid analysis of the speaker drivers, enclosure, crossover, and listening environment. The result of investigating and correcting is a speaker that approaches the ideal of transparency, one that never lets you know it's there.

AB/Testing

The above discussion on speaker improvements is somewhat oversimplified, since there's a great deal more to speaker analysis than watching a plot and tinkering here and there. The tester may use periodicity to discover some small ripple in the response, but the decision as to whether or not this is affecting the sound depends on the listener, and most listeners are almost unbelievably flexible in their perception of sound. In most cases, they're unaware of how their own mental processing is fooling them.

Mike Wright held a speaker listening test in which listeners came into the room while a set of speakers were playing. Then

noises behind the curtain indicated that the speakers had been changed, and the test was repeated. The listeners liked the first set, and said that the second set were inferior to it. In fact, the speakers were never touched. What had happened is that the room acoustics dominated the sound environment when the people first entered for the first test. By the time of the second test, they were used to the room and began to judge differently. There's also the fact that novelty affects perception; musicians often prefer someone else's instrument—for a while. When the novelty wears off, they're more objective about deciding.

The curtain in the above tests is also used in other testing because visual cues are so important to sound perception, particularly the localizing of a sound. Mike said that additional speakers placed at either side of the listener will cause them to swear that the stereo image is much wider, even though the side speakers are not even connected.

Level settings are extremely important during comparison testing of speakers. The usual wisdom is that one dB is the minimum sound level difference we can detect, but the ear is much more sensitive to change in the midrange area; if speakers are tested with a level difference of about 0.5dB, the higher level gives the vague impression of brighter response. If the speakers are switched using the same amplifier, the more efficient speaker sounds louder and brighter.

There's also evidence that the right ear perceives high frequencies in a different manner than the left, a fact which may be due to the partitioning of the brain.

The speakers under test cannot occupy the same space, so room acoustics will cause a different sound response even if the speakers are identical. If the test is interrupted and the speakers are interchanged, the delay may not let the listener retain accurate impressions of the sound.

To sum up, the A/B test must be done under extremely well-controlled circumstances in order to reveal anything meaningful. Like statistics, they can be made to prove anything you want.

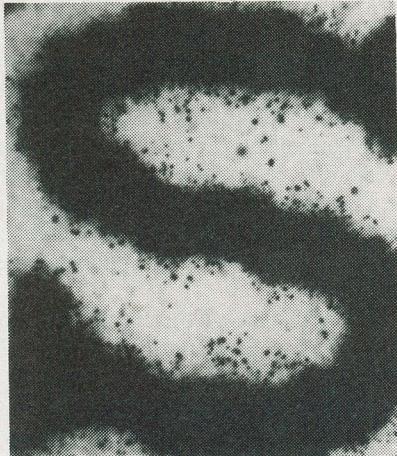
And how well did this research benefit the Dayton Wright line of speakers? They can definitely have a right to the claim of transparency; their sound indicates meticulous care in design, so much so that Stereo/Video guide of October, 1987 rated them as the number-one speaker. ■

Special thanks to Mike Wright for the time spent explaining speaker testing.

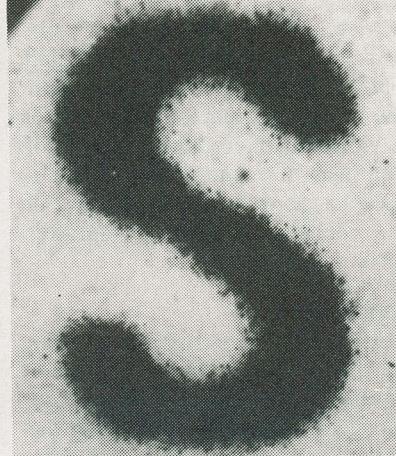
FOR YOUR INFORMATION

New Video-Tape Dubbing Facility

Agincourt Productions Limited opened a new, 65,000 square foot, state-of-the-art production centre in September of this year. The facility will be the largest full service, one stop, video duplication facility in Canada. This move has been prompted by the necessity to address every detail of an ever expanding and complex video duplication market. The facilities will provide Agincourt Productions Ltd. with a potential of 3,000 slaves and a ten high speed duplicators, a totally automated master control centre, video tape winding facility in a class 1,000 clean room, and a packaging using automated equipment that offers flexibility and a fast turn around time. Recognizing the need for a high standard of security, the plant is equipped with the latest in alarm systems, and has camera surveillance operating seven days a week, around the clock.



Laser (50x)



Edge Emitter (50x)

Advanced Printing Device

Scientists at the Westinghouse Research and Development Center in Pittsburgh have demonstrated a low-cost device in a laser printer that may replace the lasers now used. Unlike the laser light-sources employed in most of today's non-impact printers, the new all-solid state light source — called a thin-film electroluminescent (TFEL) edge emitter — has no scanning mirror or other moving parts.

Westinghouse have demonstrated printing at 400 dots per inch, and expect to go up to 1,000, giving the higher resolutions needed to expand the market for non-impact printers into desktop publishing, including halftones and Japanese characters. In testing, a 10 page-per-minute laser printer with a 300 dots per inch printing capability was operated with a 400 dots per inch TFEL edge emitter array replacing the laser. Because the printer's photosensitive device, a photoreceptor, was matched to the laser's wavelength (780 nanometers), it was only about 50% sensitive to the light from the edge-emitter (peak wavelength: 585 nanometers). Yet the edge-emitter produced superior letters with smoother edges (see above).

Credit Card Phones In Rental Cars

Bell Cellular has installed 100 credit card cellular telephones in Tilden rental cars in Montreal for a six month trial period beginning November 7, 1988. It is the first installation of cellular credit card phones in rental cars in Canada and the largest single cellular credit card application in the country.

For each call placed, a rate of \$1.95 per minute will apply, covering air time, hardware and billing costs. There will be a two minute minimum charge. Provincial sales tax and any applicable long-distance charges will be added to the customer's next credit card bill.

To use the phone, a customer passes a major credit card through a magnetic strip reader in the base of the unit. Once the card is approved, the phone can then be used to call anywhere in the world, from anywhere in the Bell Cellular network. As rentals are of short duration, a capacity to receive calls will not be available.

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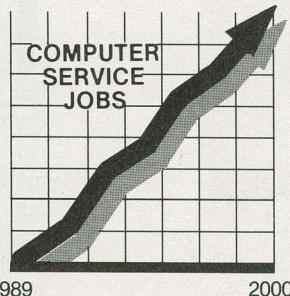
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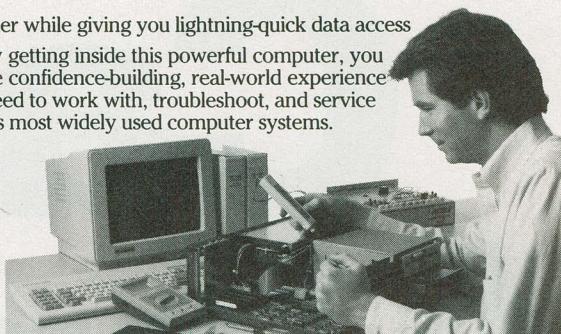
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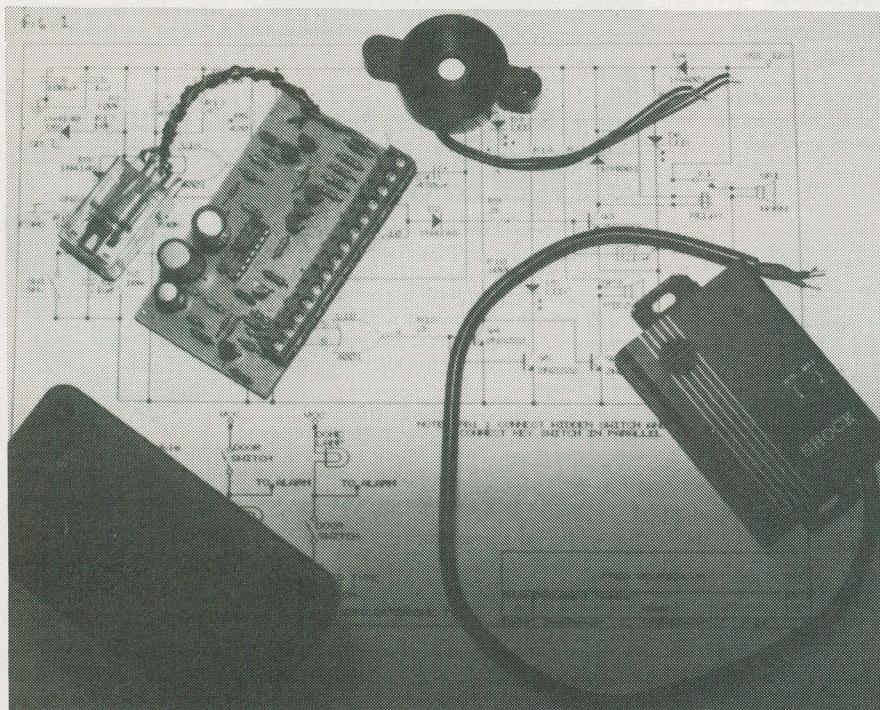
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11 — 128

Professional Car Alarm

**Protecting Your Car
With Multiple Sensors**

FRED BEDRICH JR.



Imagine, an alarm system that has all kinds of professional features which you can build at home. This article contains all the plans and details to permit even the novice electronic enthusiast the opportunity to build and install his or her own pro-alarm system.

The idea behind the system is to warn the potential criminal before he actually commits the crime on your vehicle that the car is well protected. At this point he makes his decision whether to proceed or not once the alarm has activated. The amateur criminal (which often cause the most damage) will definitely be scared off. As for the pro, if he wants what is yours, even if you had two pitbulls, your mother-in-law and a \$2,000 alarm system in your vehicle, he will probably take what he wants and with my luck leave my mother-in-law behind. I personally have had my car's window smashed and dash ripped apart on three occasions. Not once did I have an alarm system. Now I install an alarm system on my vehicle before it even leaves the dealer's show room.

How It Works

This project was intended for people who own jeeps, convertibles or vehicles with T-tops. It is fairly sophisticated, simple to build and easy to install. A similar commercial unit, installed, would set you back at least \$500.00. This system can be put together for under \$120.00 installed and working. The project comprises of several sections; a control panel comprising of 4 LEDs, 2 electronic shock detectors and a key switch. The control panel which handles all information, monitors the 2 shock detectors and sends related information to the 4 LEDs. There is also a tone which is heard to warn you that the system is in the process of being armed. It also monitors the key switch, all timing signals and controls the siren. The LED panel is very simple, it has one LED to monitor power, one LED to monitor shock detectors, one blinking LED to advise you that the system is armed and ready to be triggered, the fourth LED is used as a memory to warn you that the alarm was triggered. The key switch is mounted on the outside of the vehicle to allow you time to get in and disarm the alarm system. Disarming is done by flipping a hidden switch. The shock detectors are fully electronic. They have a LED mounted in each unit and a pot control to adjust the sensitivity. They can be adjusted to detect a fly landing on the hood. The shock detectors work on a simple principle. There is a small magnet which is rubber mounted. It is placed in

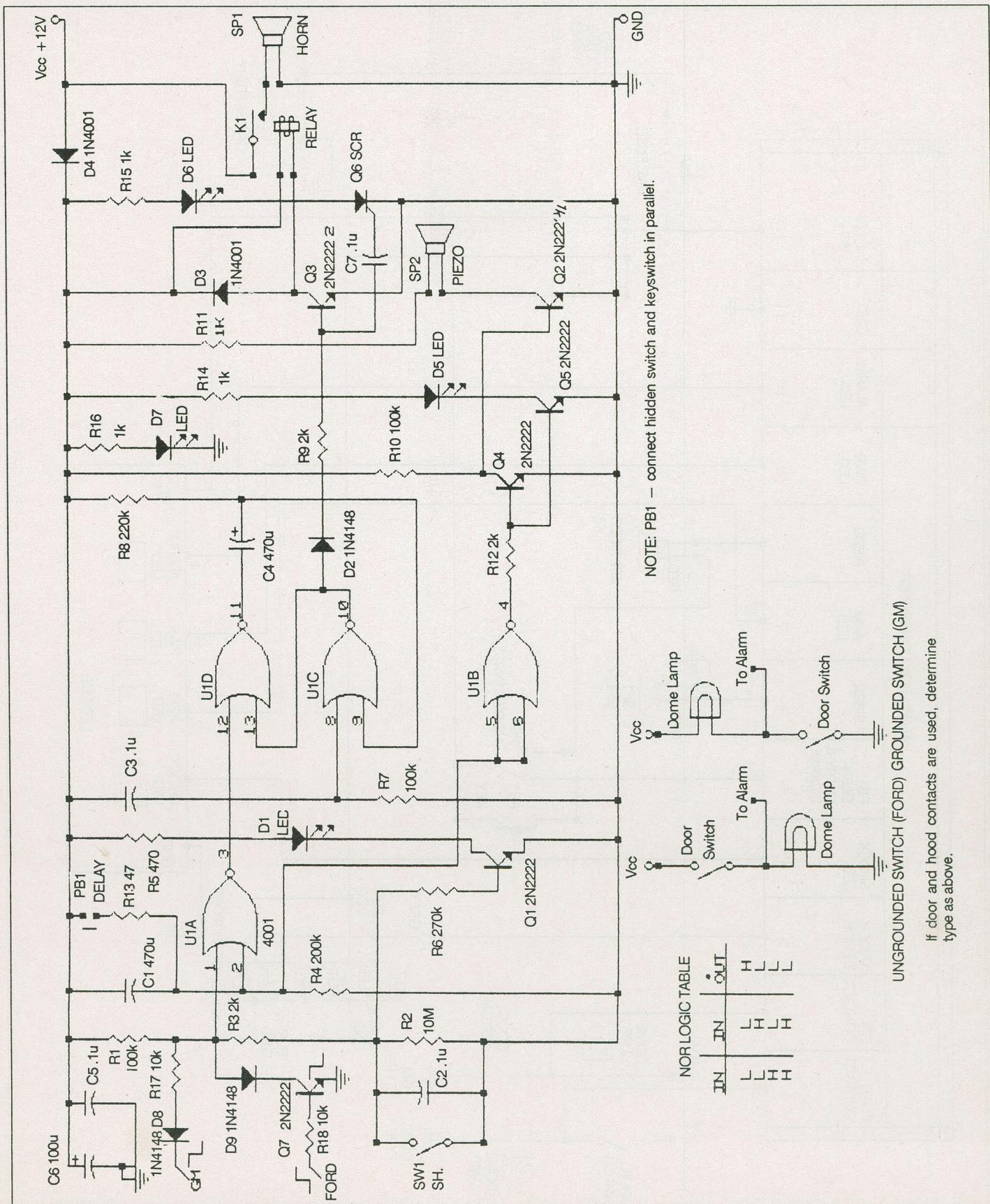


Figure 1. The schematic of the car alarm.

Professional Car Alarm

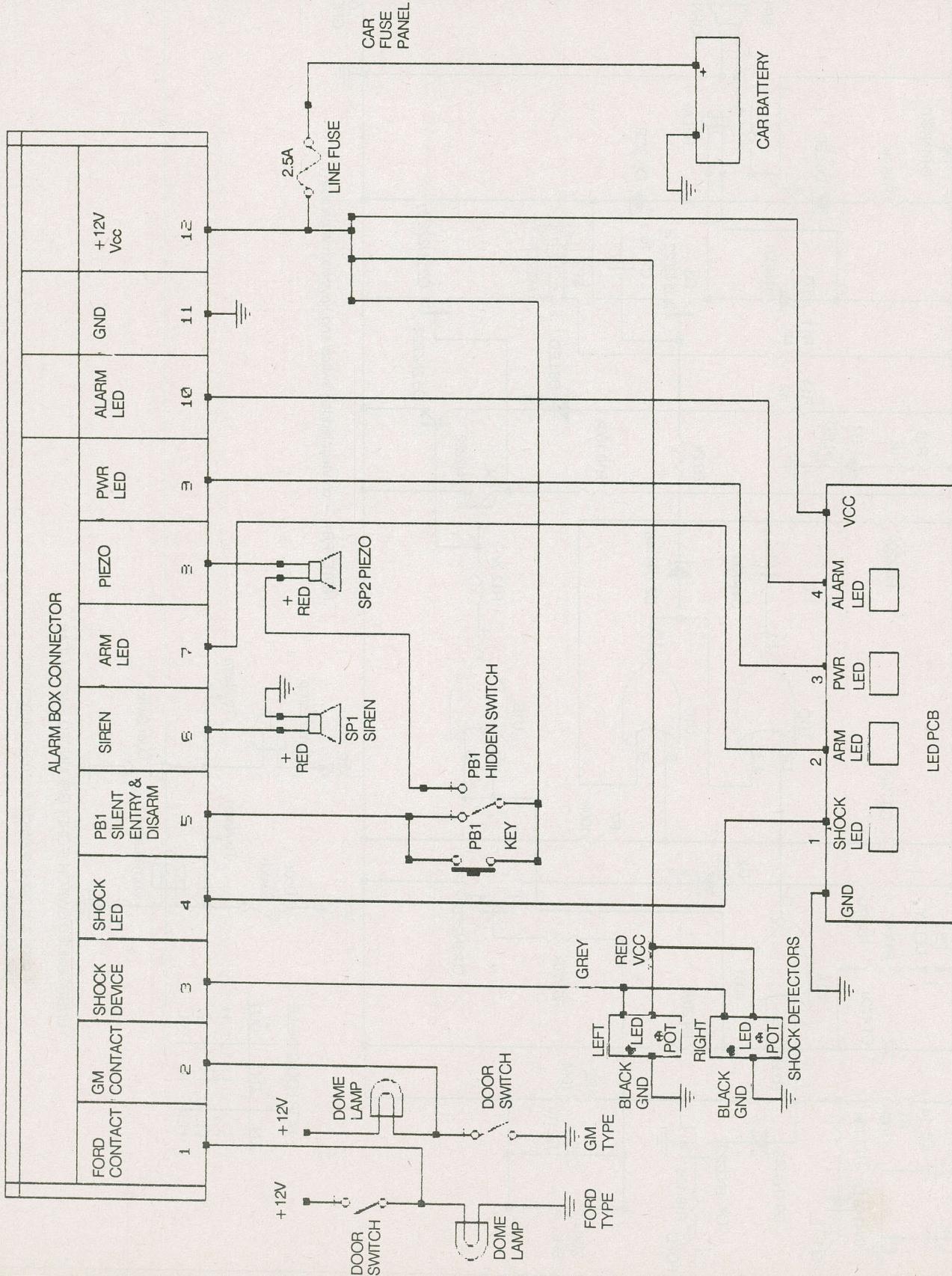


Figure 2. The wiring diagram for the car alarm.

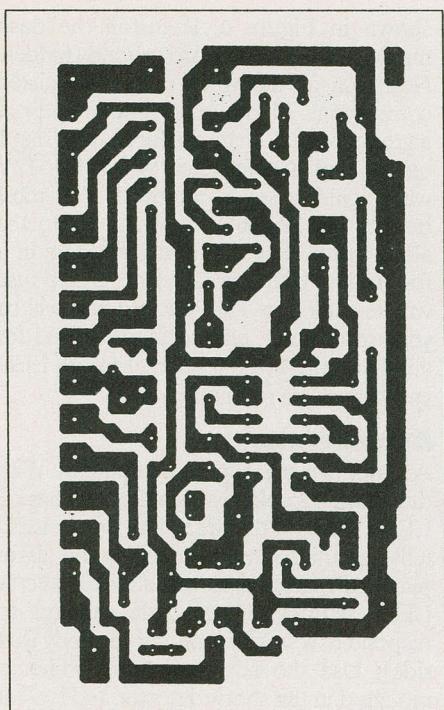


Figure 3. Main PCB..

front of a coil. When a vibration reaches the unit, the magnet vibrates and acts as a generator with the coil. The small voltage produced by the coil is sent to a voltage comparator who's threshold is adjusted to light up an LED and cause its output to go low.

The Working System

Suppose you are about to leave your vehicle, there will be 2 LEDs lit. The first LED tells you the power is OK. The second LED indicates the two shock detectors are stable. Tapping the dash would extinguish the LED momentarily to advise you it detected your presence (a vibration). At the same time, the LED on either or both shock detectors will light up and extinguish. If both LEDs on the dash are lit you can leave the vehicle. You flip the concealed switch and hear the tone coming from the piezo warning you the alarm is in the arming process. You exit the vehicle at this point. The time you have is determined by construction. The tone stops after the selected time and the third LED starts flashing rapidly. This indicates the alarm is armed. When you return to your vehicle the three LEDs should still be lit up. If the fourth LED is lit, someone has tampered with it. To enter the vehicle, simply insert the key in the momentary contact switch and enter. Observe the red blinking LED has stopped flashing and the piezo is active. Flip the concealed switch and the tone stops. There should be only 2 LEDs lit up; power and shock detector. If the fourth LED is on, the siren rang for a time determined upon construction, then the siren reset and re-armed itself ready for the next trigger.

Construction

Construction of the main control panel should pose no particular problems. Observe Figure 4. The relay is mounted off the board. There are 12 wires going to a connector mounted on outside of alarm box (this facilitates connections and gives you the chance to waterproof the alarm box with silicone). Apply bathtub silicone on inside lid to form tight seal. Drill one hole as shown 1/4 inch in order to pass 14 wires to connector. Spray lacquer may be used on PCB to give long lasting durability, especially if the alarm is being installed in a jeep. Double face tape is used to hold relay, circuit board and connector to alarm box. The next step is to mount the 4 LEDs on to the desired circuit board. See PCBs. Two styles were given depending upon the dash space in which these LEDs are to be mounted. LED sockets were used to hold the board in place in the dash. Cosmetics will not allow you to fasten PCB to dash with screws, so a dab of silicone is also used to secure the back of the PCB to the dash. This is done in order to stop LEDs from being pushed in when washing the dash, etc.

Installation

Installation of the whole system should take about 4 hours. You will need a drill and 2 bits. One bit to drill the hole for the con-

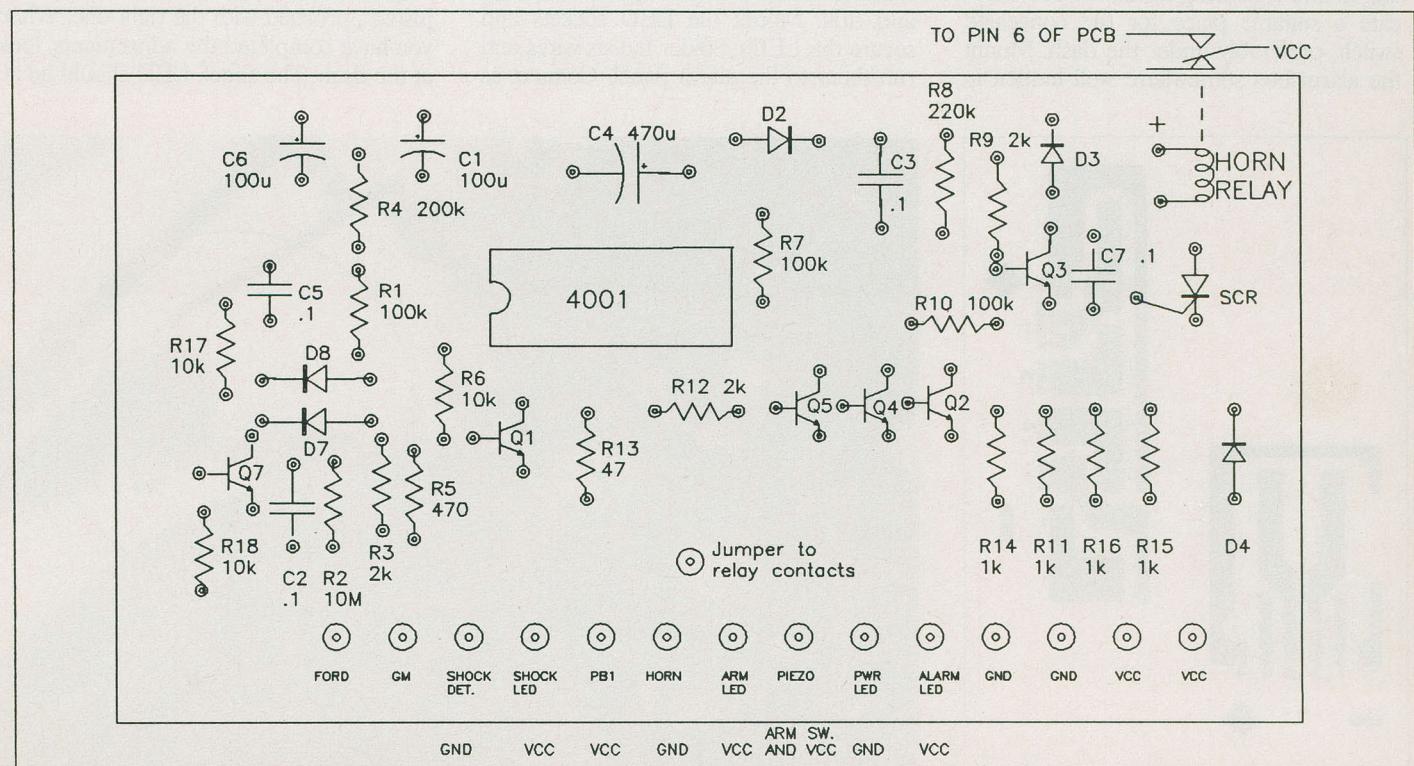
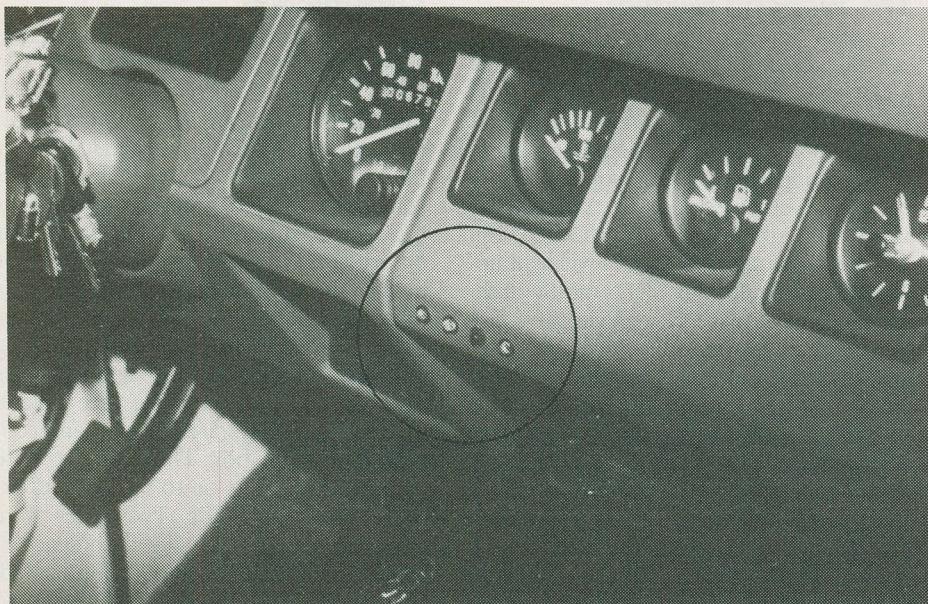


Figure 4. Component overlay for main PCB (not to scale).

Professional Car Alarm



The four LEDs are shown located on the dash.

sealed switch and siren, the other for the keyswitch on the fender. Examine Figure 2 carefully for wiring diagram. Start by drilling the hole in the fender, make it somewhere easy to get to and wire up. Next, drill two holes in the engine compartment for the siren. Mount the siren facing towards the firewall and down towards the ground. This will prevent water and snow from getting in and remaining inside the siren. Locate a suitable place for the concealed switch, preferably under the dash. Mount the alarm box somewhere well hidden in

the car compartment. Try not to install it under the hood, it may get damaged by heat. Fasten it down with 2 face tape. Proceed to mount the shock detectors directly on to side panels, one on each side. Shock detectors work best if mounted near the doors on side panels but screwed into the body, directly on to steel. Remove the section of the dash where you wish to install LEDs. Mark off 4 holes of 1/4 inch and drill. Mount the LED sockets and secure the LEDs. Solder the six wires and run them to the alarm panel. Connect as

shown in Figure 6. Reinstall the dash making sure the wires are properly hidden. Next, run all the wires to the associated components. Find a good ground and run a ground wire. Locate the fuse box. Using a meter, find a connection which has 12V when ignition key is removed. You must have a live 12v at all times going to the alarm panel. For safety reasons, wire in a fuse in line with this 12V lead; a 2.5a fuse will be sufficient. This line and fuse will be your reset point, eliminating the need for another switch (use it to reset fourth LED and stop alarm from ringing)..

Adjustments

Adjustments are kept to a minimum. With the alarm completely installed, you have 2 LEDs lit up on the dash. The power LED tells you that power is reaching the alarm panel, the second is the shock detector LED. Adjust the left side shocker to respond to a small hit on the car body (left side). Use the adjustment pot which is mounted in the shock detector and look at the LED on the shock detector. The LED should light up. If not, turn adjustment clockwise to increase sensitivity. You will probably tend to adjust shocker too sensitive. Be lenient or else a car parking next to yours might be all that's needed to trigger the alarm. Trial and error with readjustments will eventually lead you to the desired sensitivity. Once the left side is adjusted, proceed with the right one. When you have completed the adjustments, look at the dash. The shock LED should be lit.

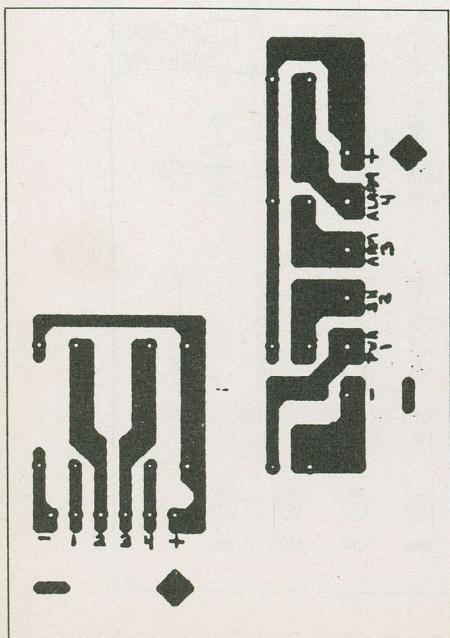
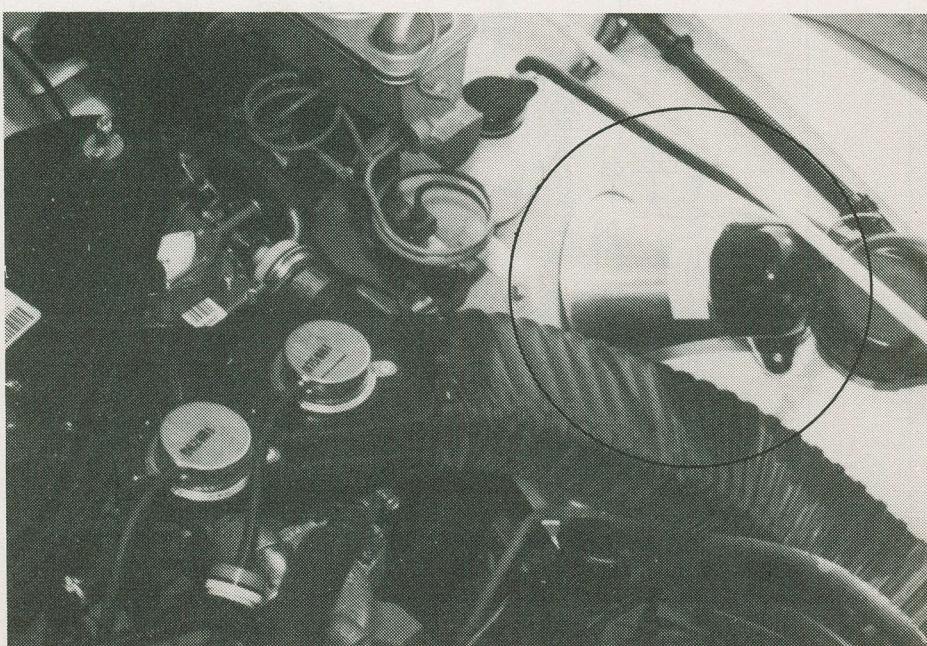


Figure 5. Use either LED printed circuit.



Note the siren mounted towards the firewall and pointing to the ground.

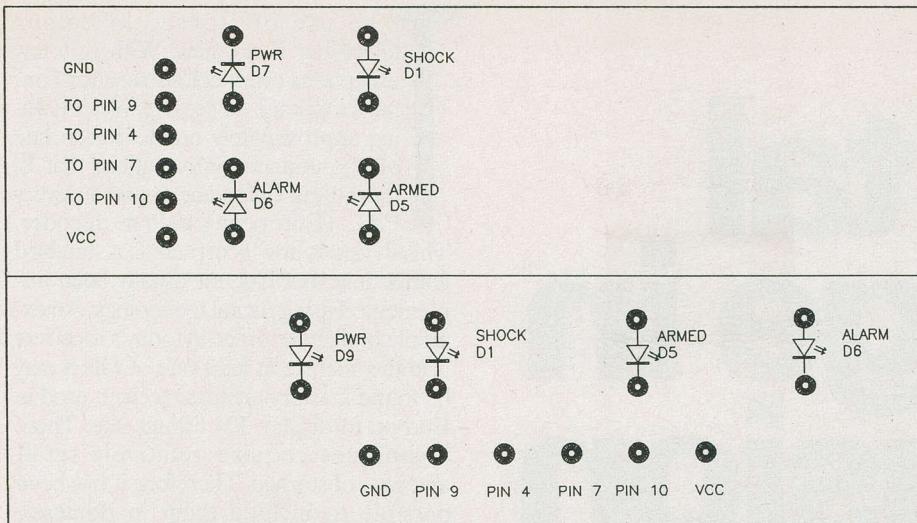


Figure 6. Either of these LED PCB overlays may be used. The upper one is for LEDs in a square, the lower for LEDs in a row.

Hit any part of the vehicle. The LED should extinguish momentarily. The alarm should now be functioning properly. Try it out a couple of times. Time the delays to make sure you have sufficient time to enter and leave the vehicle. Let the alarm signal ring once to make sure it turns on. It should turn off after a time delay. Remember, an alarm is only a means to scare off the average thief.

Technical Description

There are three separate inputs. U1A forms the basis of the input stage. Pin 2 is connected to C1 and R4; these form a timing circuit. The time it takes to charge C1 is approx. $(C1 \times R4) \times 1.1$. At this point pin 2 will go low. C1 value may be changed to increase or decrease enter and exit time. R13 is connected across C1 through the key switch and hidden switch (PB1) to pull pin 2 of U1A high, also discharging C1. R1, R2, R3 form a voltage divider keeping pin 1 of U1A. R3 keeps pin 1 of U1A slightly above GND potential if SW1 (shock detector) is activated. C2 prevents any spikes from occurring on line which could destroy IC. Door and hood contacts could be connected if desired. D8 and R17 wait for a low input and prevent a permanent high from being fed to 1A pin 1. Vehicles such as GM use this arrangement; 12V going to the dome lamp waiting for the door switch to close. This sends a low to U1A upon closing of the door switch. D8, Q7, R18 form an inverter. Ford uses the arrangement of a low waiting a high. C6 and C5 filter any noise on the power line. Q1 follows the input of U1A pin 1. Q1 is switched on grounding LED D1 through the current limiting

resistor R5. If a low input is present at 1A pin 1, Q1 is turned off, opening the path between D1 and the ground. U1B inverts the signal present on U1A pin 2. It also follows the charging circuit of C1 and R4. Initially the output of U1B is low. The output of U1B goes to inverter Q4, the output of Q4 is taken from the collector an fed to the base of Q2. Q2 is switched on and SP2 will ring. When C1 is charged, 1B's output will go high and Q4 is switched on. The collector of Q4 goes low and this causes Q2 collector to go high, in turn, shuts off SP2. The base of Q5 is connected to the output of U1B. When U1B's output is low Q5 is switched off. The collector being high will turn off LED D5. Once the output of U1B goes high, Q5 will turn on and the collector will go low allowing LED D5 to turn on. R14 and R11 limit the current which LED D5 and SP2 will receive to about 20mA. U1C and U1D form a flip flop. C3 and R7 allow the flip flop to reset upon power up. R8 and C4 give the "on" time of the flip flop. To determine the different timings use the formula $(C3 \times R7) \times 1.1$. The output is fed to the blocking diode D2 and biasing resistor R9. During the on time of flip flop, Q3 is switched on, causing its collector to go low. This activates the relay and horn SP1. D3 is used to shunt out the current when the relay coil collapses (power is removed). C7 lets a pulse from the flip flop pass causing SCR Q6 to latch up. Current will flow from the SCR to LED D6 and the limiting resistor R15, causing the LED to light up. In order to reset the SCR, power must be removed entire circuit. D4 is used to ensure proper polarity. Limiting resistor R18 and D7 monitor power. ■

PARTS LIST

Resistors

R2	10m
R3,9,12	2k
R4	200k
R5	470ohm
R6	270k
R7,10	100k
R8	220k
R11,14,,15,16	1k
R13	47ohm
R17,18	10k

Capacitors

C1,4	470uf 16V
C2,3,5,7	.1uf
C6	100uf 16V

Semiconductors

U1	4001 Quad NOR gate
D1,7	LED high intensity green
D5	LED blinking (Radio Shack 276-036)
D6	LED high intensity red
D2,8,9	14148
D3,4	1N4001
Q1,2,3,4,5,7,2	N2222 or 2N3904
Q6	SCR (Radio Shack 276-1662)

Miscellaneous

SW1	Model A-180 available at : Addison Electronics, 20th Ave., Montreal, Quebec H1Z 3S7
SP1 Horn (siren 12V 0.5 amp).
SP2 PIEZO (Radio Shack 273-060).
K1 Relay 12V single contacts 3amp.
PB1-A	Momentary Key Switch (Radio Shack 49-523).
PB1-B	DPDT Switch (Radio Shack 275-626).
	Utility box approx. 2" x 4" x 1 1/2" (Radio Shack 270-222).
	Terminal strip 12 position (Radio Shack 274-679).
	Fuse holder inline and fuse 2 1/2 amp (Radio Shack 270-1238).
	Double face tape.
	Screws to mount horn, shock detectors.
	PCB main alarm PCB and LED PCBs predrilled available through: F.R.E.D. 5387 Moreau, Chomedy, Laval, Quebec H7W 9Z7
	\$16.00 main PCB, \$8.00 LED PCBs, add \$2.00 postage and handling.
	All resistors are 1/4 watt.

Digital Storage in Television Receivers

Improving the TV image quality with digital processing.

DR. H. VIRANI



The use of storage in colour televisions is not new. With very few exceptions every colour receiver contains a storage device capable of holding approximately one television line of chrominance information; that is, the quartz delay line found in every PAL (European) colour decoder. This device is now accepted as a standard component, but has not usually been implemented using digital technology. An example of digital storage in today's receivers is in the teletext, at least one of which may be found in every teletext receiver, used in Europe to display TV listings, etc. These techniques require relatively small amounts of storage. Therefore it has been possible to include them in domestic receivers at a reasonable cost. The cost of digital memory devices is decreasing rapidly and within the next 5 to 10 years it is predicted that it will be economic to include large amounts of memory in domestic TV receivers. It is also interesting to consider the improvements which may be made to subjective image quality by the use of large stores—in particular one or more picture (frame) stores. This article considers some of the possibilities for memory based signal processing in TV receivers.

Continued on page 46

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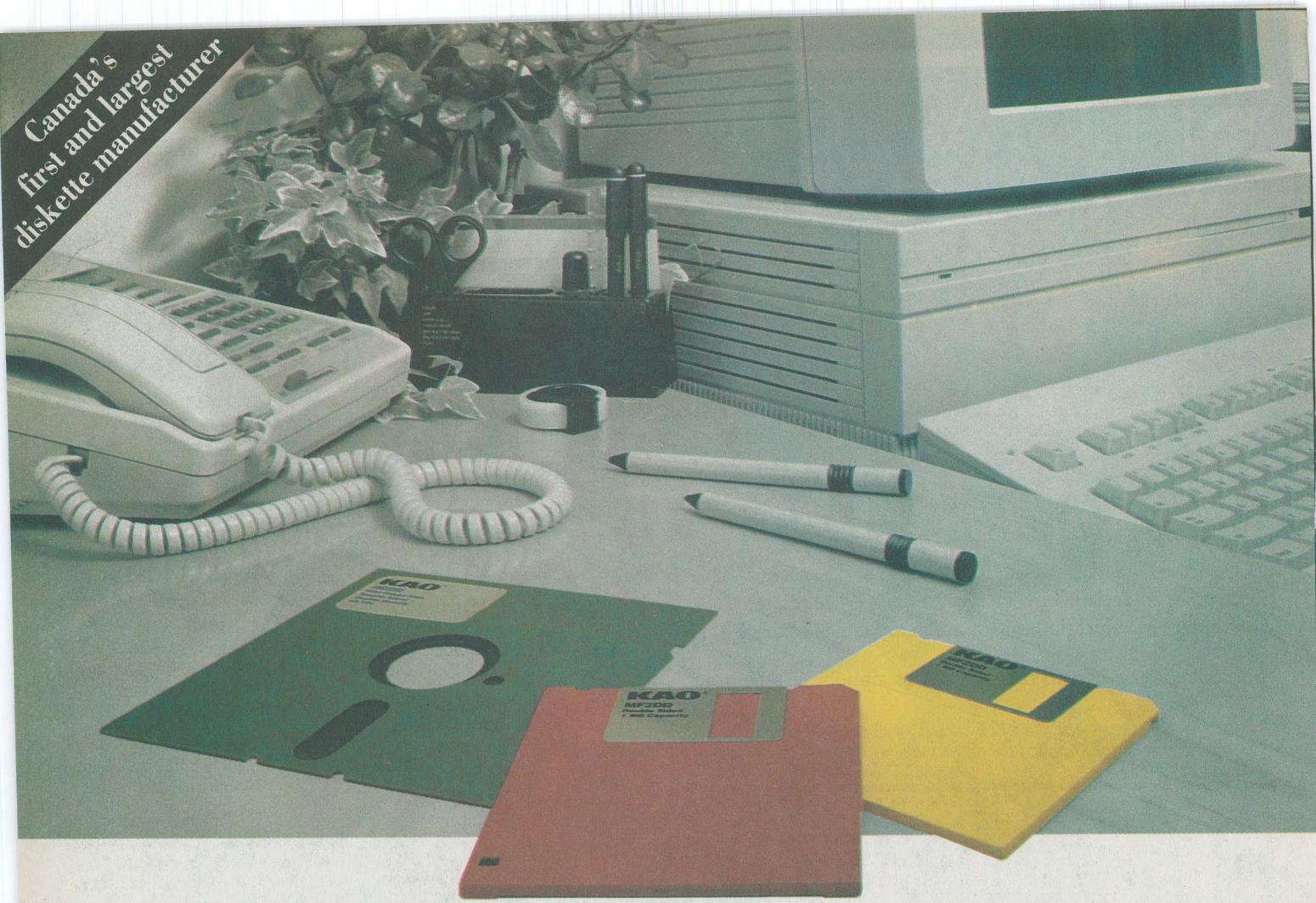
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This book is aimed at beginners and those of limited experience of electronics. Using the simple component and circuit testing techniques in this book the reader should be able to confidently tackle servicing of most electronic projects.

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Complementing Book PB74, "Electronic Music Projects", BP174 provides more advanced projects, such as a flanger, a phaser, mini-chorus and ring modulators, percussion synths, etc. Each project has an Introduction circuit diagram and constructional notes.

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R.A. Penfold
A companion to BP107. Describes a variety of projects that can be built on plug-in breadboards using CMOS logic IC's. Each project contains a schematics, parts list and operational notes.

**BP92: ELECTRONICS SIMPLIFIED -
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This is a book written especially for those who wish to participate in the intricacies of electronics.

**BP192: MORE ADVANCED POWER
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Robert Penfold
A companion to BP76, this book covers switched mode supplies, precision regulators, tracking regulators, computer-controlled supplies, etc.

**BP222: SOLID STATE SHORT WAVE
RECEIVER FOR BEGINNERS** \$7.80

R.A. Penfold
In this book, R.A. Penfold has designed and developed several modern solid state short wave receiver circuits that will give a fairly high level of performance, despite the fact that they use only relatively few and inexpensive components.

**BP197: INTRODUCTION TO
THE AMSTRAD PCs** \$20.00

Recently introduced to Canada, the Amstrad PC is an MS-DOS computer for general and business use. This book explains all you need to know to start computing.

**BP150: AN INTRO TO
PROGRAMMING THE
SINCLAIR QL** \$7.80

Helps the reader make the best use of the Sinclair QL's almost unlimited range of features. Complements the manufacturer's handbook.

**BP48: ELECTRONIC PROJECTS
FOR BEGINNERS** \$7.80

F.G. Rayer, T. Eng. (CEI), Assoc.IERE
Another book written by the very experienced author - Mr. F.G. Rayer - an in the newcomer to electronics will find a wide range of easily made projects. Also, there are a considerable number of actual components and wiring layouts, to aid the beginner.

**BP135: SECRETS OF THE
COMMODORE 64** \$5.85

This book is intended as a beginner's guide to the Commodore 64.

**BP155: INTERNATIONAL RADIO
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An invaluable aid in helping all those who have a radio receiver to obtain the maximum entertainment value and enjoyment from their sets.

**BP130: MICRO INTERFACING
CIRCUITS - BOOK 1** \$9.00

Aimed at those who have some previous knowledge of electronics, but not necessarily an extensive one, the basis of the book is to help the individual understand the principles of interfacing circuits to microprocessor equipment.

**BP131: MICRO INTERFACING
CIRCUITS - BOOK 2** \$9.00

Intended to carry on from Book 1, this book deals with practical applications beyond the parallel and serial interface. "Real world" interfacing such as sound and speech generators, temperature, optical sensors, and motor controls are discussed using practical circuit descriptions.

**BP51: ELECTRONIC MUSIC AND
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RECORDING** \$5.85

This book sets out to show how Electronic Music can be made at home with the simplest and most inexpensive equipment.

**BP74: ELECTRONIC MUSIC
PROJECTS** \$10.00

R.A. Penfold
Although one of the more recent branches of amateur electronics, electronic music has now become extremely popular and there are many projects which fall into this category. The purpose of this book is to provide the constructor with a number of practical circuits for the less complex items of electronic music equipment, including such things as a Fuzz Box, Waa-Waa Pedal, Sustain Unit, Reverberation and Phaser Units, Tremolo Generator, etc.

**BP110: HOW TO GET YOUR
ELECTRONIC PROJECTS
WORKING**

R.A. Penfold
We have all built circuits from magazines and books only to find that they did not work correctly, or at all, when first switched on. The aim of this book is to help the reader overcome these problems by indicating how and where to start looking for many of the common faults that can occur when building up projects.

**BP86: AN INTRODUCTION TO
BASIC PROGRAMMING
TECHNIQUES**

This book is based on the author's own experience in learning BASIC and also in helping others, mostly beginners to programming, to understand the language.

**BP234: TRANSISTOR
SELECTOR GUIDE** \$15.00

Listings of British, European and eastern transistor characteristics make it easy to find replacements by part number or by specifications. Devices are also grouped by voltage, current, power, etc., includes surface-mount conversions.

**BP233: ELECTRONIC HOBBYIST
HANDBOOK**

A single source of easily located information: colour codes, pinouts, basic circuits, symbols, etc.

**BP101: HOW TO IDENTIFY
UNMARKED IC'S** \$1.95

An unusual and fascinating chart that is highly recommended to all those interested in electronics and which will hopefully pay for itself many times over, by enabling the reader to use IC's that might otherwise have been scrapped.

**BP121: HOW TO DESIGN AND
MAKE YOUR
OWN PCBs** \$5.85

The purpose of this book is to familiarize the reader with both simple and more sophisticated methods of producing printed circuit boards. The emphasis of the book is very much on the practical aspects of printed circuit board designs and construction.

**BP125: 25 SIMPLE AMATEUR
BAND AERIALS** \$5.85

This book describes how to build 25 amateur band aerials. The designs start with the simple dipole and proceed to beam, triangle and even a mini-rhombic.

**BP180: ELECTRONIC CIRCUITS
FOR THE COMPUTER CONTROL
OF MODEL RAILWAYS** \$9.00

Shows how home computers can easily be applied to the control of model railroads and other quite sophisticated control. A variety of projects are discussed as well as circuits for train position sensing, signal and electric points control, etc.

**BP78: PRACTICAL COMPUTER
EXPERIMENTS** \$5.25

The aim of this book is to enable the reader to simply and inexpensively construct and examine the operation of a number of basic computer circuit elements and it is hoped gain a fuller understanding of how the mysterious computer "chip" works.

**BP185: ELECTRONIC SYNTHESIZER
CONSTRUCTION** \$9.00

With this book a relative beginner should be able to build, with a minimum of difficulty and at a reasonably low cost, a worthwhile monophonic synthesizer and also learn a great deal about electronic music synthesis in the process.

**BP115: THE PRE-
COMPUTER BOOK** \$5.85

Aimed at the absolute beginner with no knowledge of computing, this entirely non-technical discussion of computer bits and pieces and programming is written mainly for those who do not possess a microcomputer but either intend to one day own one or simply wish to know something about them.

**BP72: A MICROPROCESSOR
PRIMER** \$5.25

In an attempt to give painless approach to computing, this inexpensive book will start by designing a simple computer and then the short-comings of this simple machine will be discussed and the reader is shown how these can be overcome. A glossary of microprocessor terms is at the end of the book.

**BP42: 50 SIMPLE LED.
CIRCUITS** \$5.85

Contains 50 interesting and useful circuits and applications, covering many different branches of electronics, using one of the most inexpensive and freely available components.

**BP85: INTERNATIONAL
TRANSISTOR
EQUIVALENTS GUIDE** \$9.00

This book is designed to help the user find possible substitutes for a popular user-oriented selection of modern transistors and includes devices produced by over 100 manufacturers.

**BP140: DIGITAL IC EQUIVALENTS
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Shows equivalents and pin connections of a popular user-oriented selection of Digital Integrated Circuits. Includes European, American and Japanese devices.

**BP100: AN INTRODUCTION
TO VIDEO** \$5.85

This book is for the person who has just, or is about to buy or rent video equipment but is not sure what it's all about.

**BP136: SIMPLE INDOOR
WINDOW AERIAL**

Shows how to build a simple indoor aerial.

**BP156: AN INTRODUCTION TO
QL MACHINE CODE** \$10.00

The powerful Sinclair QL microcomputer has some outstanding capabilities in terms of its internal structure. With a 32-bit architecture, the QL has a large address range, advanced instructions which include multiplication and division. These features give the budding machine code programmer a good start at advanced programming methods. This book assumes no previous knowledge of either the 68008 or machine code programming.

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Windscreen wiper delay, darkroom timer and metronome projects are included. Some of the more complex circuits are made up from simpler sub-circuits which are dealt with individually.

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Adrian Michaels

Find equivalents and cross-references for both popular and unusual integrated circuits. Shows details of functions, manufacturer, country of origin, pinouts, etc... includes National, Motorola, Fairchild, Harris, Intersil, Philips, ADC, AMD, SGS, Teledyne, and many other European, American and Japanese brands.

BP7: RADIO AND ELECTRONICS COLOUR CODE AND DATA CHART \$3.00

Opens out to Wall Chart approximately 584 X 457mm. Includes many Radio & Electronics Colour Codes in use in UK, USA, Europe and Japan. Covers Resistors, Capacitors, Transformers, Field Coils, Fuses, Battery Leads, etc.

BP144: FURTHER PRACTICAL ELECTRONICS CALCULATIONS AND FORMULAE \$15.00

This book covers many aspects of electronics where a knowledge and familiarity of the appropriate formulae is essential for a fuller understanding of the subject. An essential addition to the library of all those interested in electronics be they amateur, professional or student.

BP147: AN INTRODUCTION TO 6502 MACHINE CODE \$10.00

The popular 6502 microprocessor is used in many home computers; this is a guide to beginning assembly language.

BP225: A PRACTICAL INTRODUCTION TO DIGITAL ICs \$7.00

This book deals mainly with TTL type chips such as the 7400 series. Simple projects and a complete practical construction of a Logic Test Circuit Set are included as well as details for a more complicated Digital Counter Timer project.

BP47: MOBILE DISCOTHEQUE HANDBOOK \$7.80

Divided into six parts, this book covers such areas of mobile "disco" as: Basic Electricity, Audio, Ancillary Equipment, Cables and Plugs, Loudspeakers, and Lighting. All the information has been subdivided for quick and easy reference.

BP59: SECOND BOOK OF CMOS IC PROJECTS \$7.80

This book carries on from its predecessor and provides a further selection of useful circuits, mainly of a simple nature. The book will be well within the capabilities of the beginner and more advanced constructor.

BP88: HOW TO USE OP-AMPS \$11.80
E.A. Part

A designer's guide covering several op-amps, serving as a source book of circuits and a reference book for design calculations. The approach has been made a non-mathematical as possible.

ELEMENTS OF ELECTRONICS - AN ON-GOING SERIES
F.A. Wilson, C.G.I.A., C.Eng., \$11.80 EACH

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Although written especially for readers with no more than ordinary arithmetical skills, the use of mathematics is not avoided, and all the mathematics required is taught as the reader progresses.

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BP63: BOOK 2. This book continues with alternating current theory without which there can be no comprehension of speech, music, radio, television or even the electricity utilities.

BP64: BOOK 3. Follows on semiconductor technology, leading up to transistors and integrated circuits.

BP77: BOOK 4. A complete description of the internal workings of microprocessor.

BP89: BOOK 5. A book covering the whole communication scene.

BP194: MODERN OPTO DEVICE PROJECTS \$10.00

This book provides a wide range of optical designs including such things as optoelectronics, ultra-bright LEDs and passive IR detectors.

BP37: 50 PROJECTS USING RELAYS, SCR's & TRIACS \$7.80

F.G. Rayer, T. Eng., (CEI), Assoc. IERE. Relays, silicon controlled rectifiers (SCRs), and bi-directional triodes (TRIACs) have a wide range of applications in electronics today. This book gives tried and practical working circuits which should present the minimum of difficulty for the enthusiast to construct. In most of the circuits there is a wide latitude in component values and types, allowing easy modification and ready adaptation of them to individual needs.

BP84: DIGITAL IC PROJECTS \$7.80

F.G. Rayer, T. Eng., (CEI), Assoc. IERE. This book contains both simple and more advanced projects and it is hoped that these will be found of help to the reader developing a knowledge of the workings of digital circuits. To help the newcomer to the hobby the author has included a number of board layouts and wiring diagrams. Also the more ambitious projects can be built and tested section by section and this should help avoid or correct faults that could otherwise be troublesome.

BP44: IC 555 PROJECTS \$10.00
E.A. Part, B.Sx., C. Eng., M.I.E.E.

Every so often a device appears that is so useful that one wonders how life went on before it. The 555 timer is such a device included in this book are Basic and General Circuits, Motor Car and Model Railway Circuits, Alarms and Noise Makers as well as a section on the 556, 558 and 559 timers.

BP95: MODEL RAILWAY PROJECTS \$7.80

Electronic projects for model railways are fairly recent and have made possible an amazing degree of realism. The projects covered included controllers, signals and sound effects: stripboard layouts are provided for each project.

BP94: ELECTRONIC PROJECTS FOR CARS AND BOATS \$7.80

R.A. Penfold
Projects, fifteen in all, which use a 12V supply are the basis of this book. Included are projects on Windscreen Wiper Control, Courtesy Light Delay, Battery Monitor, Cassette Power Supply, Lights Timer, Vehicle Immobiliser, Gas and Smoke Alarm, and more.

BP49: POPULAR ELECTRONIC PROJECTS \$10.00

R.A. Penfold
Includes a collection of the most popular types of circuits and projects which, we feel sure, will provide a number of designs to interest most electronics constructors. The projects selected cover a very wide range and are divided into four basic types. Radio Projects, Audio Projects, Household Projects and Test Equipment.

BP99: MINI-MATRIX BOARD PROJECTS \$7.60

R.A. Penfold
Twenty useful projects which can all be built on a 24 X 10 hole matrix board with copper strips. Includes Door-buzzer, Low-voltage Alarm, AM Radio, signal Generator, Projector Timer, Guitar Headphone Amp. and more.

BP103: MULTI-CIRCUIT BOARD PROJECTS \$7.80

R.A. Penfold
This book allows the reader to build 21 fairly simple electronic projects, all of which may be constructed on the same printed circuit board. Wherever possible, the same components have been used in each design so that with a relatively small number of components and hence low cost, it is possible to make any one of the projects or by re-using the components and P.C.B. all of the projects.

BP98: POPULAR ELECTRONIC CIRCUITS \$10.00

R.A. Penfold
This book is a collection of 20 projects with some explanations. The projects are concerned with generating signals and processing signals. Amplifiers and filters account for most of the book but comparators, Schmitt triggers and other circuits are covered.

BP107: 30 SOLDERLESS BREADBOARD PROJECTS \$9.00

R.A. Penfold
A "Solderless Breadboard" is simply a special board on which electronic circuits can be built and tested. The components used are just plugged in and unplugged as desired. The 30 projects featured in this book have been specially designed to be built on a "Verobloc" breadboard. Wherever possible the components used are common to several projects, hence with only a modest number of reasonably inexpensive components it is possible to build, in turn, every project shown.

BP127: HOW TO DESIGN ELECTRONIC PROJECTS \$9.00

Although information on stand circuits blocks is available, there is less information on combining these circuit parts together. This title does just that. Practical examples are used and each is analysed to show what each does and how to apply this to other designs.

BP122: AUDIO AMPLIFIER CONSTRUCTION \$6.75

A wide circuits is given, from low noise microphone and tape head preamps to a 100W MOSFET type. There is also the circuit for 12V bridge amp giving 18W. Circuit board or stripboard layout are included. Most of the circuits are well within the capabilities of even those with limited experience.

BP179: ELECTRONIC CIRCUITS FOR THE COMPUTER CONTROL OF ROBOTS \$12.00

The main stumbling block for most would-be robot builders is the electronics to interface the computer to the motors, and the sensors which provide feedback from the robot to the computer. The purpose of this book is to explain and provide some relatively simple electronic circuits which bridge the gap.

BP106: MODERN OP-AMP PROJECTS \$7.80

R.A. Penfold
features a wide range of constructional projects which make use of op-amps including low-noise, low distortion, ultra-high input impedance, high slew-rate and high output current types.

BP108: INTERNATIONAL DIODE EQUIVALENTS GUIDE \$7.00

Cross-references European, American and Japanese diode part numbers. Besides rectifier diodes, it includes Zeners, LEDs, Diacs, Triacs, SCRs, OCIs, photodiodes, and display diodes.

BP118: PRACTICAL ELECTRONIC BUILDING BLOCKS — BOOK 2 \$7.60

R.A. Penfold
This sequel to BP117 is written to help the reader create and experiment with his own circuits by combining standard type circuit building blocks. Circuits concerned with generating signals were covered in Book 1, this one deals with processing signals. Amplifiers and filters account for most of the book but comparators, Schmitt triggers and other circuits are covered.

SUPERDISK SOFTWARE

SUPERDISK 1

EBL This is the latest version of the Extended Batch Language, an easy-to-use program that lets you customize hard disk and floppy disk systems for less experienced users. Create custom menus and make your system idiot-proof — without the need for a complicated DOS shell program.

TIRED You may want to save this one for April 1st. Sneak it into a friend's BATCH file, or run it from DOS (while your friend is at the coffee urn). Spectacular, but harmless results.

BREAKON Ever need to exit from a program in a hurry? Or do you get frustrated when your computer hangs up because of a software problem. You could press the RESET button, or try running BREAKON. This little beauty works with many popular programs.

PKARC If you want to keep archive copies of important, but rarely needed data files or programs, an archiving program is an inexpensive alternative to buying more floppy disks. Archive files with PKARC and extract them with PKXARC. These utilities are fast, accurate and they'll help save on disks.

DSIZ DSIZ is a utility that will provide information on the size of the various directories on a hard disk system.

CONVER An easy-to-use unit conversion utility. This provides imperial, metric and U.S. conversions for all common units of measurement — and many uncommon ones as well. Provides well over 200 conversions.

CUTE TIME Friendlier than a clock program, but not as accurate, running QT gives on an English approximation of the time. "It's about half past two", for example.

DRAIN Another April Fool's program. Run DRAIN to remove the water from your disk drive. Keep 'em rolling in the aisles.

XEQ This utility is designed to let you manage those small but useful programs that tend to clutter up disks. Files can be added, removed and run from XEQ.

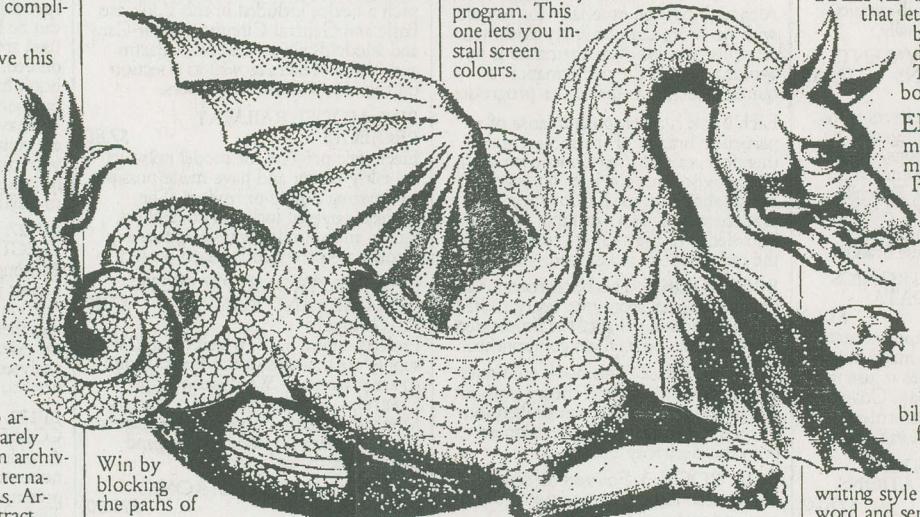
ORDER Use ORDER to change the order in which files appear in the directory on your disks. This utility will create order out of chaos in large directories. Great for hard disks.

TSR For SideKick, ProKey and SuperKey users — or anyone who uses co-resident software. This utility lets you remove co-resident programs (such as those mentioned above) from memory — without rebooting your computer!

\$19.95

SUPERDISK 2

BLOCKADE Play with up to two human and five computer players. This territorial game will generate hours of excitement. This version lets you select a number of game parameters such as strategy and speed.



Win by blocking the paths of your opponents in order to gain territory.

DALEKS A game of skill and logic based on the Dr. Who television series. Use your talents to rid the universe of the dreaded Daleks.

RLOGIC Save the world from nuclear annihilation. This one is trickier than you might expect.

CAVERNS OF GINK A strange name for a strange game. Explore the Caverns and see what you'll find.

LETFALL A great way to learn touch typing and have fun too. This one lets you work on tricky key combinations and reports on your progress.

WIMPS Maneuver your spaceship and blast away at marauding wimps. A great zero gravity simulation.

FLIGHTMARE As an Omegan jet fighter ace, your job is to protect your factories from dessert hordes.

PYRAMID Hop on each triangle in the pyramid and score points, but watch out for the snakes!

HI Just run HI from DOS or from within a BATCH file and be prepared for a daily dose of inspired wit and wisdom. From Confucius to Murphy, this program has it all.

\$19.95

SUPERDISK 3

DSCAR This is the "dBase Source Code Analyzer and Reporter", a utility

that lets you pretty up and document your dBase programs. This program is very flexible in analyzing your files. You can even edit the reserved word list so that it will work with future updates of dBase III as well as with dBase compilers such as Nantucket's Clipper.

SET COLOUR A simple, but well written routine that can be called from within any dBase program. This one lets you install screen colours.

the DOS TYPE command or any ASCII word processor to read the files.

\$19.95

SUPERDISK 4

TREND is an easy-to-use program that lets you make projections based on past historical data which the user enters. The program can display both line and bar-graphs.

EE2 is a handy "Environment Editor" that lets you make quick changes to DOS PATH and SET commands. The few simple commands needed to run this utility are explained in a small help screen. Requires DOS 3.1 or higher.

PCSTYLE A public domain program which tests your prose and provides a quick test for readability. While not a substitute for a competent English teacher, PCSTYLE can help you improve your writing style by providing statistics on word and sentence length, percentage of action verbs, etc.

PLANIT is an interesting appointment reminder program. By keeping all of your important dates in a text file (created with your word processor), PLANIT will check the file and tell you if you have any important engagements. A host of options enable you to set up messages which repeat weekly, monthly and yearly. It even warns you of important dates before they arrive!

CPU2 is a speed checker/benchmark program. It measures the speed of your IBM PC compatible system against a standard IBM XT configuration. The assembly language source code is included, so you can see how it's done.

EXPENDIT is a good expenditure tracking program. Designed primarily for personal use, EXPENDIT lets you set up various categories for your monthly expenses to help you see where all the money goes. A variety of printed reports can also be generated.

MAKEREAD is a simple, and somewhat strange utility that converts text files into programs. When one of these programs is run, it prints the text contained in it on your screen. An odd program, but it could be useful for generating help short messages for inexperienced users.

REMINDER is a good on-screen clock/reminder utility. Press ALT-R to see the time. You can also enter daily appointments and REMINDER will chime when the time is at hand.

FORTUNE is a complete text simulation of one of TV's most popular game shows. All that's missing is Vanna and the commercials.

FIRE is a great little game which

simulates a forest fire. You devise complex strategies using water bombers, etc. in order to quench the flames.

BLORTII is a fast-paced colour graphics game. You have to be quick with this one!

\$19.95

SUPERDISK 5

DR.COM Need to look at a file, or copy it - fast! Call the DR! DR.COM is a small assembly language program that lets you quickly call up the files in a directory. You can display files in order by name, date or size. Files can be viewed, copied, renamed, or deleted with a little help from the DR.

SIMCGA is the newest version of an indispensable utility for users with Hercules-type graphics cards. This one lets you flip back and forth between Hercules and Colour Graphics programs with two tiny utilities which can be run from DOS or Batch files. Yes, you can run CGA games with your Hercules card!

DATASCAN is a shareware program which is designed to give scientists, statisticians and business users a quick overview of the relationships between the variables in their data. When you load a data file, DATASCAN plots an array of small scatter-graphs, showing the various relationships of up to nine variables. The user can "zoom in" on any graph for more detailed information. You can extract a variety of statistical information such as correlation coefficients, and plot linear regression lines. DATASCAN is not intended to replace any of the more powerful statistical programs such as SAS, but it is powerful enough to enable you to detect statistical correlations within your data. This will pace the way for more indepth study. Requires a Colour Graphics Display. DATASCAN also works with EGA displays and Hercules compatible graphics cards using the SIMCGA utility included on this disk. Graphs can be printed on most dot-matrix printers if GRAPHICS.COM or replace graphics driver has been loaded. DATASCAN works with Lotus 1-2-3 .PRN files, or you can enter data direct.

ZENCALC is a small but powerful spreadsheet program which performs many of the mathematical operations available with commercial spreadsheets. Extensive on-line help is available by pressing the "?" key. ZEN-CALC is perfect for fast number-crunching.

PC-FLOW Flowcharting as a planning tool is often under used, simply because the use of templates can be very tedious. PC-FLOW is a flow chart designing program which makes flow-charting easy and fast. PC-FLOW lets you manipulate a variety of symbols and lines using either a mouse or the keyboard. Requires a color graphics card. A special file has been included that will let you PC-FLOW with a Mouse Systems Mouse.

\$19.95

SUPERDISK 6

YAHTZEE This is a great version of a classic game. Pit your wits against several other players, including the computer. Keeps track of high scores and has a good on-line help screen.

MAROONED - High adventure in space. Your ship has crashed on an alien planet and you must escape.



BLACKJACK - Lots of excitement and nothing to lose, this game plays a strong, but honest hand. Learn the strategy behind this diversion.

MAYAKDM2 is an enlightening text (with ASCII graphics) adventure game. You need a creative soul and a searching intelligence to escape the materialistic — and deadly — Mayan Kingdom. But greater and more meaningful pleasures can be yours if you can cross the ocean to freedom.

3DTICTAC Just like the name says, this is a 3-dimensional Tic-Tac-Toe game. And a mean game it is too! Just you and your computer in an all out battle of wits.

ICBM Save a city from nuclear annihilation. Blast those ICBMs before they blast you. Requires a colour graphics (CGA) card or equivalent.

CRSWRD is nice little program which lets you create your own crossword puzzles. It lets you enter words and clues, edit them, save them — and print them.

ROBOT is a clever game of strategy in which you maneuver a small creature around the computer screen. A number of robots will try to attack you. If the converge on you, the game ends. With careful maneuvering, you can cause the robots to destroy each other. There is also a teleport key — just to add a little more excitement.

\$19.95

SUPERDISK 7

ASTRO is an astronomy simulation program which graphically demon-

strates planetary motion around the sun. It also performs a number of calculations such as lunar phases, sunrise and sunset times. Requires an EGA display.

TOFHANOI This is a nice implementation of a classic logic problem. The object of the game is to move a tower of disks from one platform to another. But you can't place larger disks on top of smaller disks. Requires an EGA display and a logical mind.

TICK is a classic Space Invaders-type game - with a frightening twist. Maneuver a tank at the bottom of your screen and try to eliminate the giant bugs that are trying to get you. Requires a CGA display and fast reflexes.

SOPWITH2 lets you battle the Red Baron in a vintage World War I airplane. The program has realistic flight simulation - it will even stall and crash if you fly too high or too slowly. Requires a CGA display.

GOMOKU is an easy game to play, but a difficult game to win. Enter coordinates from the keyboard to place an X on the screen and try to place 5 Xs in a row. The computer will try to stop you - and you must use your wits to keep the computer from winning.

FOOTBALL is a nice NFL football simulation. It is very complete, allows you to choose any two teams you like and even includes details such as a coin toss to see which side kicks off.

HIQ is brilliant computerized version of a classic peg-jumping game. On a cross-shaped board, you try to eliminate all of the "checker pieces" by jumping over them. The object is to clear all but one piece from the board. No special hardware requirements.

KILLER is a well-executed graphics-game that lets you shoot down the "killer bees". Requires a CGA display.

\$19.95

with the operating system of the same name. This UNIX is a fast and furious pinball game. It does a great simulation of the real thing. Saves on quarters too.

VDE is a small full-screen text editor that could make a great programming editor. It's also good for "quick and dirty" text editing for BATCH files, etc. It only needs 11K of RAM, but it still boasts WordStar compatible commands and comes with an installation program to it can be customized for your own needs.

EP is a PATH editor which lets you quickly add or remove paths from your PATH statement. Small and fast, EP's program screen incorporates a complete list of editing commands to make altering your PATH statement quick and easy.

TAO is, well TAO just is, that's all. Based on the TAO of Programming, this program displays a random gem of wisdom from the Master Programmer every time you run it. More food for your AUTOEXEC file.

\$19.95

SUPERDISK 9

TAX87ONT is a comprehensive Lotus worksheet (version 1.X) for Ontario tax returns (unfortunately, we could not locate a similar worksheet for other provinces). TAX87ONT is an elegant worksheet which even includes all tax schedules. A split screen window lets you see whether you owe tax or vice versa. It's simple and easy to use.

BANKRUPT is a good worksheet for investors and potential investors. It lets you calculate the likelihood of a publicly traded corporation going bankrupt using "The Bankruptcy Predictor Formula", a formula was devised by Edward I. Altman, a financial economist at New York University's Graduate School of Business.

LOTUSX is proof that computers have been taken over by practical jokers. Run LOTUSX and an innocent looking worksheet is displayed. Press any key and the worksheet will actually "crumble" before your eyes! Slip it into colleagues AUTOEXEC.BAT file.

HANGMAN is a competent version of the Hangman word game written as a 1-2-3 worksheet! It comes complete with simple ASCII graphics.

OIL is a simple worksheet which forecasts oil prices from a number of historical factors.

123LEARN is a menu-driven macro creation worksheet. Using Version 2.00 or higher, you can use 123LEARN to record keystrokes in order to create complex macros.

CHKBKC2 is a personal finance management worksheet which lets you balance monthly income and expenditures. Customize it to suit your specific needs.

TMPDOOM is a series of mystery adventure games created as a series of 1-2-3 worksheets. Solve the mysteries by using your skill with Lotus commands. A great teaching tool.

\$19.95

LEISURE LIBRARY

VOLUME 1
COLOUR CARD
PROGRAMS

AQUARIUM make your monitor a fish tank which cannot spill onto your computer. Good for endless hours of meditation. CGA is required.

MSLIFE or more fully, the game of life for Microsoft Windows. A mouse is almost vital for setting up screens. This version has some nice features, including constant update of the MSLIFE icon.

AIRPLANE allows one to display and print blueprints for paper airplanes. Great for office mayhem. CGA and BASICA or GWBASIC are required.

SIMCGA version 4.0, the latest we've found. As with earlier SIMCGA's, this is simple to use. It supports all three CGA modes, normal, fourty column, and hi-res mono mode. All the CGA programs on this disk worked for us with SIMCGA.

HELPME cannot be described. If it does not startle, perhaps even scare people around you, find some people to show it to. Run it and listen to what happens!

SAYTIME basically just says the time. This is a resident program which will cause your system to speak the current time whenever the correct key code is entered, even when you are in another application. Great if you can't see a clock and your screen is too full for an on screen one.

CALLTIME should only be used by Torontonians. It calls Toronto's own radium clock, and grabs the time correct to the second, then installs it on your system. If you have an AT, it even installs it in the battery supported CMOS. Requires a modem connected to an outside line which can call central Toronto without long distance fees. Version 3.1.

PLANETS computes information relating to the position, distance, magnitude, and so on for the major planets in our solar system on a specific date and time. A must for space travellers. CGA required for graphic displays.

MELT clears your screen slowly. Sort of. This is the type of program which makes DOS's CLS command so ghastly boring. CGA is required.

DAZE This too, is a little weird. An excellent way to leave an unused computer, this colour demonstration leaves accounts receivables in the dust! CGA required.

WHIZ deans the inner surface of your monitor with electron brushes already available to users who have CGA compatible systems. Great for that one glaring hard to get at place.

JOYCAL is a slick joystick calibration system specially designed for those with...you guessed it...joysticks. It will support both joysticks simultaneously, calculate the centre, then tell you how to adjust your stick.

DRSLEEP, Dr. Sleepite and the Nightmare Factory is a strange ex-



perience. Get fifty thousand volts through your body, be attacked by killer pillows, and above all, avoid sleep. The mad doctor is at it again. This game requires CGA.

\$19.95

VOLUME 2
EGA PROGRAMS

MONALISA is the lady herself. The picture is drawn slowly but accurately. EGA required.

EGAD is one of the most impressive EGA demonstrations around. It has everything from flickering photos to QIX lines to a multi-shape kaleidoscope in full colour. Supports mice and exploding boxes.

EGAWAL is creates complex geometric patterns on EGA's screen. Run this and stand back and watch! Another great one for bored machines.

ROSES creates similar EGA patterns to EGAWAL, however, it creates them faster and makes them look more like flowers. The originality of program names is astounding, no?

EGASNO simulates a snowfall in

EGA. You may adjust the speed at which snow falls as well as the amount of snow actually coming down. This program is altogether unuseful, but is great for getting an idea of the absolute limits of EGA's resolution.

MGGS stands for Mandelbrot Graphics Generation System. This gem of a set of programs calculates Mandelbrot images and displays them on either CGA or EGA systems. Calculations may be done with a math co-processor if you have one installed. Version 3.2.

FRACLAND draws landscapes, shorelines and islands shaped by fractal geometry. Interesting, realistic, and BASIC source code is even included. CGA is required.

AUTUMN displays autumn colours and leaf-pile designs which are also created using fractal geometry. Source code is unavailable. CGA required.

TEAPOT is an EGA demonstration of three dimensional graphic rotation abilities. Use the cursor pad to decide which direction and on which axis your teapot will spin and from where you will observe it.

ROLEX is a giant screen sized EGA watch face which keeps accurate time, assuming your system clock keeps accurate time. Also includes the date as an added bonus. This program could be useful in offices where spare computers outnumbered spare clocks.

LINES is a collection of commands to determine how many lines your screen

will keep in EGA. Select 15, 25, 35, 43, 50, or 60. Also included is a command to give you 120 columns. Works only with EGA.

EGA2RAM takes IBM EGA BIOS and stores it in RAM, then tells the computer to refer to the RAM copy of the BIOS instead of the ROM. This speeds up many EGA screen writes, since RAM is much faster than ROM. Assembler source is included.

ATI2RAM is the same sort of thing as EGA2RAM, but it works with ATI's EGA Wonder BIOS instead of IBM EGA. Speed increases can be anywhere from fifty to one hundred percent, depending on whether the software makes direct memory writes or actually uses BIOS.

\$19.95

VOLUME 3
GRAFICS & GAMES

EGA2GIF is a memory resident utility which grabs EGA screens when you hit the key combination, and stores them on disk.

VGIF, a GIF picture viewer in EGA, can also convert GIF pictures to formats used by various paint programs, including EGAPaint, PC Paintbrush, etc. Also allows for slide shows of pictures. Included are three GIF pictures to start your own slide show.

XONIX is a fast paced game of luck and mental coordination. This is perhaps one of the most addictive games around. CGA required.

ALDO is a game which was created specifically for AT286 machines with 256K EGA cards inside 'em. It's basically a Donkey Kong clone, with really smooth graphics.

DALEKS will be a natural to all Dr. Who fans. The object of the game is simple...smash as many of the robots as you possibly can before getting killed.

PITFALL is a simple but fun exercise in futility. You are dodging the walls of a pit as you fall deeper and deeper. Trouble is, the pit gets narrower as you go.

MUMMIES is a simple low resolution game which is actually quite similar to DALEKS. While exploring the tomb of the ancient King Mut, you are set upon by hordes of mummies. Wonderful topic for a computer game, and it's fun.

SCRABBLE is Scrabble. This one is in EGA, knows all the rules, and even keeps score for you. Definitely a classic computer game, even if it can't play against you.

CHESS is a very small chess player, rather fast, not impossible to beat. CGA is used, and the pieces are made of not wood or metal, but realistic graphics. Small enough to fit in a pocket, it's just the thing to while the time away when you should be word processing.

\$19.95

ALMOST FREE SOFTWARE

VOLUME 1

PC-WRITE An earlier, compact version of this well-known word processor — perfect for program editing. PC-Write boasts features such as user-definable help screens and a 'printer ruler file' which can be customized to work with virtually any printer.

SOLFE is a small BASIC program that plays baroque music. While it has little practical use, it's a lot of fun. It's also a fabulous tutorial on how to use BASIC's sound statements.

PC-TALK A high-power telecommunications program for a low-power price. It does file transfers in both ASCII dump and MODEM7/XMODEM protocols. And, it comes with a large documentation file.

SD This sorted directory produces displays which are a lot more readable than those spewed out by typing DIR.

FORTH This is a small FORTH, written in Microsoft BASIC. A good tool for teaching the ideas and concepts of this esoteric, but useful language.

LIFE This is an implementation of the classic ecology game written in 8088 assembler code.

MAGDALEN This is another BASIC music program.

CASHACC is a fairly sophisticated cash acquisition and limited accounting package written in BASIC. It isn't exactly BPI, but it's a lot less expensive and suitable for many small business applications.

DATAFILE is a simple data base manager, written in Microsoft BASIC.

UNWS Convert WordStar documents to standard ASCII files.

HOST2 This program includes BASIC source and documentation files to allow users with SmartModems to access their PC's remotely.

\$19.95

VOLUME 2

SWEEP is a disk utility which virtually replaces the DOS COPY, REN, TYPE and DEL commands.

WORLDMAP is a graphics program which draws a very detailed map of the world. It can display its wares on your monitor, or send them out to a dot-matrix printer. CGA required.

ANITRA plays Anitra's Dance by Edvard Grieg. A beautiful addition to your computer music collection.

RAMDISK is one of the most useful utilities you'll ever plug into your PC. Once installed, it creates a virtual drive in memory on your PC.

ALIEN Plays a bizarre adventure game and will lead you into some of the most exotic spots in the universe.

FOS is a well designed personal

finance manager which will do much to help you tame your cheque books.

JKUKEBOX represents yet another PC music system. This one comes with a host of songs and some really electric graphics.

ASMGEM is one of the best text disassemblers we've come across. It takes any executable COM or EXE file and produces an assembler listing. It's surprisingly good at distinguishing between code and embedded data or text.

STRUCT will appeal to the rabid programmer in everyone. It enables MASM to be used to assemble a higher level language. Included also is a test file to illustrate the syntax.

PRTSC replaces the internal PC screen dump code with something more suited to reality. It allows one to hit the PrtSc* key and then select the print quality from a menu. It supports a number of popular printers.

BREAKOUT plays a PC version of the popular game. It will accept input from either a joystick or the keyboard. The graphics are good and the action is adjustable from a beginner's level right up to 'fast and nasty'.

UTIL is a collection system utilities which can be accessed from a single menu. Among its talents are a sorted directory, keyboard redefinition and the facility for scrolling through text files.

\$19.95

VOLUME 3

WRT DOS allows files to have a 'read only' flag, but it lacks a way of manipulating them. This pair of utilities allows you to set and unset this flag, protecting files from accidental erasure.

BROWSE is a timesaving program which provides a useful alternative to the DOS 'TYPE' command. BROWSE allows you to easily scroll through text files in order to have a quick look at a text file.

CAT If the DIR display is too dull for your taste, CAT may be just what you need. It will tell you everything you could possibly want to know about the files on your disks.

CGCLOCK is a simple little program which displays the running time in the upper right hand corner of your screen. Works with CGA displays.

CURSOR A tiny twenty-four byte program which displays a large cursor on your monitor.

CMP This program does a very elaborate comparison of two files and reports their differences.

JUMPJOE A bit like "Miner 2049'er", this game is certain to damage your mind. You get to be the janitor of a space station and deal with berserk robots and other weirdness.

CASTLE Wander through a deserted castle collecting treasures... but don't get killed by the nasties. A solution is

included should frustration set in.

78INT This small BASIC program calculates interest using the rule of seventy-eight.

MOON is one of the nicest lunar lander games we've come across. This version uses high resolution graphics and startling sound effects to hurl you to your doom in style.

PERTCHT is a BASIC program which prints PERT charts. It should interest anyone involved in project management and scheduling.

DATNOIDS is one of the strangest games ever put on a disk. In fact, mere words don't serve to describe it: you'll have to try it for yourself.

NUK-NY This is one of the nastiest bits of software we've seen. It produces a full color high resolution simulation of a nuclear attack on New York City.

\$19.95

VOLUME 4

BACKSCROLL Perhaps one of the cleverest DOS utilities. BACKSCROLL hooks itself into the PC and buffers whatever scrolls by. Using a well-thought out command structure, it allows one to scroll through text which has already scrolled off into oblivion.

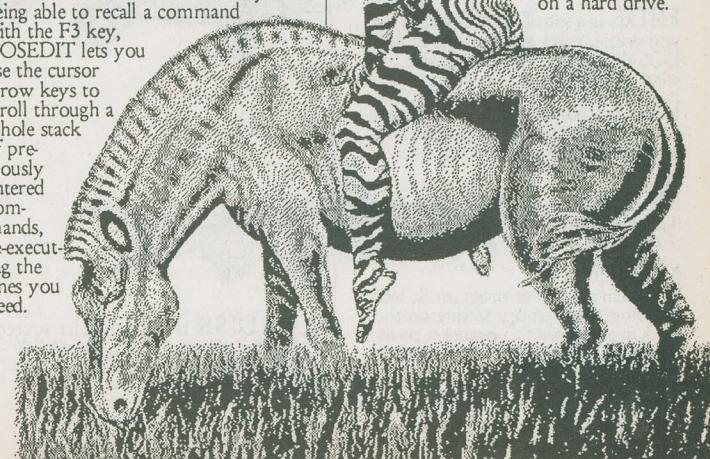
BIGCAL is a BASIC program which performs calculations on extremely large numbers.

BUGS is an off the wall ASCII game in which a player uses the cursor pad keys to move a 'nuclear fly swatter' around the screen blowing up a bug.

CRYPTO is a BASIC program which unscrambles cryptograms. It's an great study for puzzle enthusiasts.

DEFRAG is a utility that lets you "de-fragment" your disks to make your applications run faster. The utility reorganizes a disk, connecting up the fragments of files created by DOS.

DOSEDIT enhances the command line facility of MS-DOS by creating a command stack. Instead of merely being able to recall a command with the F3 key, DOSEDIT lets you use the cursor arrow keys to scroll through a whole stack of previously entered commands, re-executing the ones you need.



DUMP is a utility program designed to produce Hex dumps of object files.

FREE is a tiny file which tells you how much space is left on a disk... without having to view an entire directory listing.

KBFIX displays the status of the keyboard lock keys on the screen and expands the size of the keyboard character buffer to avoid losing bytes.

LABEL changes the labels on disk drive volumes. It's a simple utility, but useful if you use volume labels to keep track of your disks.

LIST is an improved version of the DOS TYPE command which shows you the contents of a file page by page.

MEMBRAIN is the most sophisticated RAM disk program we've seen yet. It lets users install variable sized disks and provides control over several other parameters.

MONOCLOK is a screen clock display program, designed specifically to work with monochrome displays.

MOVE is a disk utility which moves and optionally erases disk files. Using wild cards, the user can ensure that specific types of files are not MOVED by the program.

NEWBELL is a tiny program which performs the lowly task of changing the sound of the PC's control G beep.

NUSQ is a file un-squeezer. It's a useful utility for people who download compressed files from bulletin board systems.

PARCHK is a trap which prevents the system from 'freezing' when a "parity error" is encountered.

PURGEDUP is an intelligent little program which cleans up obsolete backup files. Very useful on a hard drive.

SOFTWARE FOR THE PC

PX is a cross reference generator for assembler programs. It helps you keep track of where you put procedures in large files.

QS is a DOS patch which eliminates some of the wait encountered when DOS is booted while it performs a number of system checks. The program is not compatible with all software, but is still handy to have.

SDIR is an improved sorted directory program.

SP is a clever print spooler which lets you 'print' files into a RAM buffer, leaving the user free to move on to other tasks using the computer.

SPACE INVADERS A fast variation of this popular arcade game. The graphics are superb.

SPEED is a simple program which changes some of the PC's floppy disk parameters and effectively speeds up disk accesses for some applications.

VDEL is a multiple deletion program that queries the user prior to erasing each entry. Similar to MOVE, but much smaller.

WHEREIS will locate a file on a disk even if it lurks in a subdirectory. Most useful on hard disk systems.

WIZARDS is an adventure game in the classic style, except that it ranks as one of the most sarcastic programs in creation. The program is vast... you can wander about its darkened corridors for hours.

\$19.95

VOLUME 5

AREACODE is a useful tool if you use the telephone a lot. Give it an area code and it will match it with the city in which the code is used.

D is another sorted directory program. This one emulates the CP/M style D, which is arguably more useful for most applications.

FRACTALS

An amazing implementation of the Mandelbrot Microscope, which generates unearthly images on your screen.

HIDE is a set of utilities which let you create, enter and remove invisible DOS directories. An inexpensive security strategy.

LAR is a library utility that allows you to concatenate several small files into a library to save on disk overhead.

MAIL1 is a mailing label utility written in BASIC.

MORERAM

This is an assembler program. It lets you alter the memory setting on the PC's motherboard to enable it to use more than 640K RAM. MASM & LINK Required.

MORTGAGE generates amortization charts.

MXSET lets you control the

parameters of Epson printers from the DOS command line.

PARCHK is an assembler program which requires MASM and LINK to work. It installs a trap for parity errors in your computer.

VDEL is a Delete with Verify program.

WHEREIS finds files in a complex hard disk system.

ZAXXONPC This is an incredible implementation of one of the most popular micro games ever created.

\$19.95

VOLUME 6

3-DEMON is one of the most interesting variations on Pac-Man in the known universe. Instead of simply looking at a map of a maze, this program shows you a three dimensional view of it.

DU allows you to see what the tracks and sectors on your disks look like, recover erased or damaged files, and meddle with the system tracks.

GENERAL LEDGER This is a complete general ledger accounting program. Written in BASIC, the program possesses most of the features found in commercial packages. Documentation included.

PC-CHESS is a slick chess program which makes good use of the PC's colour graphics abilities and boasts a running chess clock.

BLACKJACK is a BASIC implementation of this popular card game.

TYPE and even run programs... in short, it does almost everything DOS does but it's user-friendly.

QMODEM is a sophisticated telecommunications program that includes windowing, multiple protocols, and definable function keys.

ARC is a clever file archiving program which stores multiple files in single library files.

ZAPLOAD is a utility for programmers to handle Intel standard HEX files. Very fast and well documented.

SOPWITH Using superb graphics, SOPWITH lets you pilot a World War I biplane on dangerous bombing missions.

JSB Another BASIC music program for your collection. This one plays a soothing sonata.

STAR is one of a growing breed of small... somewhat silly... novelty programs. This one, as you might guess, draws stars.

SURFACE demonstrates the complexity of the "hat" function by graphing it.

OP is the operator program from the November '85 issue of Computing Now!

\$24.95
(2 Disk Set)

EDSCR is a screen editor which can be used with virtually any programming language from assembler to dBase III.

FK allows you to make the function keys of your PC do more useful things under DOS.

FXMASTER is a printer program for the popular Epson FX Series and compatible printers. It uses a full screen menu to enable you to easily change printer settings and modes.

INDEX allows you to generate indexes from WordStar documents... or text files from any other text editor.

KEYCLICK is a memory co-resident program which will make your keys click.

PCBW is a small utility which makes colour screen displays show up in monochrome video. Great for users with colour graphics cards and monochrome monitors.

PINBALL is a pinball simulation that is easily worth the cost of this disk.

QUICKGRAF is a powerful business graphics package which generates complex bar, line and scatter charts in medium and high resolution. An Epson with GrafTrax or compatible printer is necessary to produce hardcopy.

SERPENT is a variation on the classic snake game. Written in BASIC, this one is weird, but very fast.

SHOWCLK is yet another clock program... it's the smallest one yet, and it beeps to chime the hour.

VTREE is a graphic TREE program that shows you how the subdirectories are set up on your disk... in a fashion more easily understood than the MS-DOS TREE utility.

WORLD is a great program which allows you to zoom in on specific areas of the globe, locate major cities and perform a number of useful calculations.

\$19.95

VOLUME 8

DDCAL is a very clever perpetual calendar and desk diary. It keeps track of your appointments and performs several other functions.

PC-KEY DRAW is a great public domain paintbox program which compares favorably with many commercial applications. It'll handle multiple screen images, business graphics and superb computer art — all in full colour.

CPU is a tiny program which tells you the effective speed of your system.

XRAY is a remarkable co-resident utility which monitors what a program is doing while it's busy doing it. It allows you to interrupt the execution of your code and a look inside.

GAME — well, there are no words for this program, or, at least, none that are printable. It does use some suggestive language, and we recommend that young or sensitive users not boot it.

TUNE is a very small music generator which makes noises from within batch files.

CHASM, or cheap assembler, is just the thing if you want to get into assembly language programming but don't want to spring for the Microsoft macro assembler package.

GETDIR is a resident directory utility. It allows you to see what files are on your disks, even if you're in the middle of doing something else.

COPYPC, not to be confused with the commercial Copy II PC, is a quick disk backup utility.

LOOKIT is a browsing program that lets you scroll forward and backwards through text files — like a tiny word processor with no editing features.

SYSLOCK is a security device for hard disk users. By running this utility on your XT or compatible, access to your computer will only be granted to users with a valid password.

\$24.95
(two disk set)

VOLUME 9

SMALL C is a restricted implementation of C, producing code which is compatible with Microsoft's MASM and LINK programs — you'll need these to get it going.

MAP is an interesting little utility which will check how DOS is situated in the memory of your computer and tell you a number of things about it.

NOTE is the source file for the memory resident note pad which appeared in the March 1986 edition of Computing Now! It requires MASM and LINK to use.

PANGO is one of the wildest games we've come across for the PC. While its premise is a bit improbable, it's fast and weird — hours of fun.

PC-SPELL is a spelling checker written in BASIC. It's fast, accurate and easy to use. It can be listed if you want to see how it works, and comes with a large dictionary file and a utility to assist you in customizing it.

PEACOCK is a memory resident program which allows you to change the colours of your screen with alternate function keys.

RECOVER is a file recovery utility. It lets you look at your files one sector at a time in order to put the pieces back together.

SDB is a small relational database. It isn't dBASE III, but it also doesn't cost quite as much.

TALLY is a program which accurately counts the number of characters, words and lines in a file — all within your lifetime.

XENO edits the tracks and sectors of your disks in a user friendly format — or, at least, one that doesn't lunge for your throat every time you boot.

\$19.95

VOLUME 10

MONOPOLY A good implementation of the classic board game. Great graphics and sound. Slightly sarcastic play.

D20 is the latest version of Steve's sorted directory program. This one uses DOS two calls and handles sub-directories.

EDIT is a lightning fast full screen editor, ideal for editing program source files, dBASE stuff or other ASCII phenomena.

BANNER takes mere text and prints it sideways on your printer — in gargantuan block letters that can be read from miles away if you have a good set of binoculars.

MORTGAGE is one of the nicest mortgage programs we've seen so far — lifelong debt and ruination has never been so well formatted.

QUICK speeds up your PC quite a bit by improving video response.

SPEECH is a rather remarkable little germ of code. It talks through the PC's internal squeaker speaker. The voice isn't exactly human, but it's understandable on most machines.

PC-AR is an accounts receivable package for the PC. It will take care of the records for a small or medium sized business quite well.

\$19.95

VOLUME 11

PAC GIRL is, predictably, a variation on the almost mythical Pacman game. This one moves fast, and plays much like the arcade version.

MENU lets you create a menu-driven tree-structured environment that is friendlier and more manageable than is DOS.

Z80MU is one of the most brilliant pieces of software we've ever encountered — free or not. It actually emulates a Z80-based computer running CP/M on the PC with no additional hardware — you don't even need a V20. It will run almost all CP/M software, including old favourites like WordStar and dBase and includes features lacking in both C/PM and MS-DOS.

SERIO is the assembler file from the July edition of Computing Now! that implements an interrupt-driven terminal in higher level languages such as C. It's also suitable for use with compiled BASIC. Both MASM and Link are required to use SERIO.

BREAKDOWN is a peculiar program which takes meaningful text, analyzes it and generates meaningless, but profound-sounding prose from it. If you've been wondering if your co-workers really read your office memos and reports, try filtering your prose through this program. The effects will be astounding.

XMODEM is a C language implementation of the XMODEM file transfer protocol, from the July 1986 edition of Computing Now! It can be integrated into other programs to allow easy access to telecommunications facilities. This code requires SERIO (see above) and version three Lattice C.

GRABIT is the screen grab program from the July 1986 edition of Computing Now! It will make a useable text file from the contents of one screen at the touch of a key. MASM and Link are required.

\$19.95

VOLUME 12

CV is a small utility for changing the volume name on disks.

BREAKOUT BOX is an assembly language program that hides in memory and shows you what your serial ports are doing. It's a valuable trouble-shooting utility for pin pointing serial printer and modem problems.

ICON MAKER allows you to generate sophisticated bit-mapped

images. It's easy to use and extremely colourful, producing data that can be incorporated into other programs.

SHELL is another DOS menu program. This one is very fast, free of 'snow', and provides easy access to virtually all DOS features.

STRIKER is an experience. It's a brilliantly written helicopter game in the style of Choplifter, complete with professional high resolution graphics and running spies.

It will help you to find the resident utilities you have loaded and, more importantly, is great for sorting out peculiar interactions between multiple resident programs.

SOFT TOUCH is a keyboard macro program not unlike ProKey. It allows you to store up to twenty five thousand key strokes, has a built in screen blanker and great wandering herds of other features.

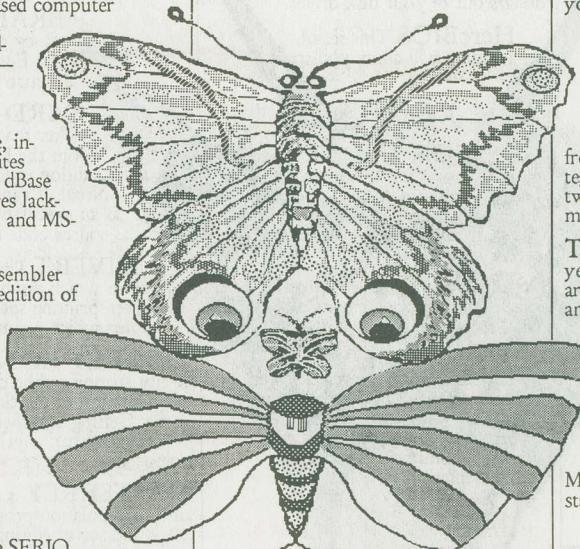
SUB CHASE is a first rate graphics arcade game. One sails across the clear blue sea — or green sea, depending on what sort of monitor you have — heaving depth charges off the stern to blow up subs. Requires a colour graphics card.

TheDRAW is an ANSI screen editor. It allows you to create and edit full colour screens of text and graphics which can be displayed from DOS — in full colour — or integrated into programs. Requires DOS two or better, ANSI.SYS and is more fun with a colour monitor.

TREK is the best Star Trek game yet devised for the PC. The graphics are stunning, the complexity is intense and the action scoots along at warp nine as soon as the program gets going. Requires a colour card.

CROSSWORD is a utility which translates text files from one application to another. It supports several popular word processors, including WordStar, WordStar 2000, Multimate, XYwrite, SideKick and standard ASCII.

\$19.95



RAMSET is a RAM expansion program from the July 1986 edition of Computing Now! It allows you to exceed the PC's 640K memory limit. Ramset also lets you bypass the PC's time-consuming memory check.

TRAP is the high-resolution Gemini patch program from the May edition of Computing Now! It makes the Gemini 10s suitable for use with Personal Composer, but is easily modified to fix most bit-mapped printing problems. MASM and Link are required to assemble the program.

\$19.95

VOLUME 15

ALTAMIRA This is one of the nicest public domain paint box programs available for the PC. It does first rate pictures. Colour graphics card required.

FRACTAL This is the C source code for the fractal generator that first appeared in the August 1986 issue of Computing Now! Requires a C compiler and a colour graphics card.

NEMON This is a really weird game. You get stuck in the catacombs of King Nemon with nothing more than your wits and a flashlight. You have to find some keys, some treasures and, hopefully, a way around a host of arcade nasties.

THOR used to be the god of thunder. Now he appears to be the world's most sophisticated desk calendar program for keeping track of appointments.

ROUND 42 This is bizarre variation on the theme of space invaders. One of the best computer games in creation. Requires a colour graphics card.

V20 is a CP/M emulator for users of the NEC V20 chip. Replace your existing 8088 with a V20, score this little program and most CP/M software will run on your system as if someone had stolen half the bits out of your PC. Regular MS-DOS isn't affected. Requires a V20 chip.

\$19.95

VOLUME 14

CUT AND PASTE is a memory resident program that allows you to grab text from the screen of any application and paste it into any other application that accepts characters for input.

INT13 will help you unravel the copy protection schemes of your software so you can make archive copies — just in case the cat takes a fancy to your masters. It prints a log of direct disk accesses and where they're called from so you can check out the code that's going after specific tracks, the heart of most protection systems.

PMAP tells you what's living in the memory of your system — and where.

VOLUME 16

ARCDIR The archive file compression system is the most efficient way to store large files in a small space. This simple ARC directory utility was featured in the November 1986 edition of Computing Now! It includes both a COM file and the source code so you can see how it works. Requires a C compiler if you want to meddle with it.

BRICKS The "Little Brick Out" game is one of the classic programs for microcomputers. This splendid version will get you turned onto simple games all over again.

DX This is a small DX-7 voice librarian, as found in the Book of Computer Music. It includes both a COM file and the assembler source code.

MOREROOM If you have a hard drive system you may have noticed that it's extremely inefficient with small files. Here's a collection of tricks to get substantially more space on your disk.

E88 is a tiny — but powerful — text editor. Neat and compact it is perfect for programming.

EXPERT Commercial Expert Systems software is still in its technological infancy. If you're interested in learning about expert systems and how they relate to your computing needs, you should try this simple program.

FULLDOS A DOS enhancement program that makes the DOS user interface behave in a rather more friendly manner. It creates a command stack and lets you re-execute previous commands.

K9 This is yet another resident keyboard enhancer — with a difference. Aside from expanding the keyboard buffer, installing a screen timeout and so on, it makes a number of the alternate keys 'hot', giving you dozens of unique functions.

InstantMENU This is the code for the Instant Menus article which appeared in the November 1986 Computing Now!. With it, you can create elaborate batch file menus without programming. Menus can be easily altered with a text editor or word processor. Source code is included.

PALERT We've all occasionally run out of disk space while inside an application and discover that we've been dumped back to DOS unexpectedly. This program warns you of an impending full disk.

\$19.95

VOLUME 17

ARC512 This is the latest version of the de facto standard PC file compression and archiving utility. It will

create, maintain and crack unpack ARC files. See the November 1986 edition of Computing Now! for more about this.

ATC ATC stands for "Air Traffic Controller". In this colourful simulation of the rigors of managing the planes at a busy airport may, among other things, renew your interest in train travel.

DRAW POKER This is a really slick little poker machine simulation. The graphics are good, the play is fast and the machine doesn't always win. It's a shame it won't spew silver dollars out of your disk drives.

HercBIOS This set of routines will allow you to

clude an elaborate event timer, a note pad, an ASCII code chart and so on. It's well done, fast, and fairly small.

PD This program redirects the output of one's system from the printer port to a disk file. It lets you to use things that normally insist on having a printer on line even if you don't own one, or don't want hard copy.

\$19.95

**VOLUME 18**

BRADFORD A fancy printing program for Epson and Gemini dot-matrix printers.

CARD This is the draw poker machine program from the December 1986 edition of Computing Now!. It's included here both as an executable COM file and as source code in C.

DIVERT This is a tiny program which doubles the effective screen printing speed of most programs which print through DOS.

DONKEY KONG This is a pretty snappy public domain implementation of the classic arcade game. Getting squashed by oil drums is more fun than anything. Requires a colour card.

MASTERKEY is a public domain disk manipulation program that offers track and sector editing, unerasing files, and all the general low level fiddling that the expensive programs do.

PRINTER This is the PRINTER.BAS program from the December 1986 edition of Computing Now!. It reprograms the high end characters of an Epson FX-80 (or compatible) printer to make them print IBM PC screen block graphics.

QUICKEY This little program speeds up keyboard action.

ZOARRE This is another dungeon game, but terrifically well done and very intricate. It displays a picture of the room you're in, zaps you with various monsters and generally tries its very best to kill you. If you liked Castle you'll freak over this one.

\$19.95

VOLUME 19

BOTH is a small utility which can slash your paper bill by allowing you to print long files on both sides of the paper.

DIAGS Written by the author of Z80MU, this collection of tools will be nirvana for the experienced PC programmer. It does things like generate an annotated list of all the interrupt vectors in your PC, let you meddle with the 6845 registers, test most of the ins and outs of your system and so on. It's a brilliant bit of work.

GRCP Graphic cut and paste is a memory resident tool that allows you to scoop things from a PC high resolution graphic screen and pop them into other applications.

LOCKERUP This tiny microbe of code sleeps in your system until you have to leave your PC for a while. Then it enables you to irrevocably lock up your keyboard until you come back to restart it. It's perfect for offices where there are more fingers than hands to contain them.

MEGAPEDE Just when you thought that it was safe to play ASCII games again... This one is a sophisticated variation of the classic "snake" programs and it plays with the speed of a boa constrictor. Don't count on winning for a while.

MURPHY Sort of an iconoclast in a can, this program will print a random selection of several hundred of murphy's laws, corollaries and commentaries thereon each time it's run. If you put it in your AUTOEXEC.BAT file it will say something clever each time you start your computer.

QUEBERT This fast PC implementation of the classic arcade game is every bit as exciting as the real thing but lacks a coin slot. Jump down the mountain, avoid the snake and try not to get clobbered with fresh fruit. Sounds like real life...

SAT This is a powerful, menu driven satellite data downlink terminal, as discussed in the December 1986 edition of Computing Now!

SCAV This is a great program for people who buy economical floppy disks and just about everyone else who can't afford a clean room for their PCs. It cruises through one's disks looking out bad sectors and restores previously 'fried' disks to usefulness.

SimCGA The utility does an astoundingly good job of making a Hercules graphics card behave like a colour graphics adapter. It will let you run most CGA software.

STUFFIT Stuffit is a disk management utility which stuffs files into the inner tracks of a floppy disk, allowing the outer tracks to be used for work space. This improves the disk access times and the reliability of mostly full disks considerably.

\$19.95

VOLUME 20

ARTIFICIAL ART generates an ever changing graphic image on your PC — with accompanying sound. While it may seem a bit pedestrian, it's a gas to watch. Requires a colour graphics adapter.

AsEasy This is a public domain spreadsheet package, very similar in its abilities to the more popular functions of Lotus 1-2-3. Unlike Lotus, it doesn't cost anything and it isn't copy protected.

ASYNC This is an assembler file which creates a device driver to make the PC's serial ports behave as they should, with interrupt driven buffered inputs and outputs. This is a programmer's delight. Requires MASM to use.

ChessII This is one of the best chess programs yet devised for the PC. Aside from being small and fast, it lets you physically pick up the pieces and move them rather than entering board co-ordinates. Plays an evil game, too.

HAUNT This is a haunted house adventure game. You wander around looking for the mysterious pumpkin man while picking up things, encountering ghosts and, if you're not careful, getting busted for shoplifting.

LPTX The most flexible printer redirection program imaginable, this thing lets you set up virtual printers, that is, disk files to capture the output of things that think they're printing. Includes both executable and source files.

PITFALL This is a supremely clever ASCII game. Aside from being an absolutely superb game in itself, it's a clever use of the PC's screen. You get to pilot a spaceship down a winding, rather nasty pit. More fun than being beamed into a supernova.

RAMDISK Once you've installed a normal RAM disk, it's there for the duration. This one allows you to change the size of the disk on the fly, or blow it away all together, without having to reboot anything.

ZAPDRAW This is the C source code for the Graphics in C article from the January 1986 edition of Computing Now! It creates a general purpose high speed PC graphics library, suitable for use on both the colour card and the Hercules board. Requires Lattice C or something similar.

\$19.95

MIDI debugger runs with the popular ROland MPU-401.

SHELL This is a command.com replacement that implements a UNIX-like environment. It supports many features that DOS would like to have, and a much tighter command structure.

MUSIC SYSTEM This is a pair of programs which allow you to edit and play three voice music on the PC. These programs are not compatible with PC/ATs.

DEV This is a tiny utility that will locate the device drivers in your system's memory. It includes the assembly language source code.

\$19.95

VOLUME 22

CALENDAR This program prints up a calendar for any month in the twentieth century. It's very useful if you want to know which days people were being idle on in 1921, for example.

DFA This is a strange disk accelerator program which attempts to anticipate which sectors your software will call for and fetch them when the computer isn't busy. It can speed up some programs quite noticeably.

FSDEBUG lets you scroll forward and backward through a disassembly, set breakpoints, trace code and so on, all with a full screen display.

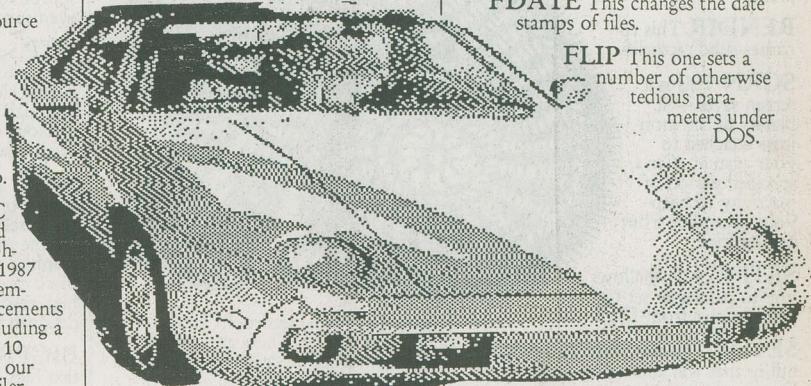
GRAB.ASM The source code for the graphics grab program from the March 1987 issue of Computing Now! Requires MASM to assemble.

SCROLL This is a resident scroll lock key enhancement. It's not all that exciting, but, then at 247 bytes, it's not all that big either.

SIDEWAYS This program lets you print awkward-sized documents sideways on an Epson printer.

PLAYSONG This is the source code for the linkable interrupt driven music playing package from the March 1987 issue of Computing Now! It also includes the MUSIC.C demonstration program. Requires MASM to assemble and a language compiler to use — preferably C.

PC-WRITE The latest version of this phenomenal word processor, this thing is enough to turn you off any other word processing package on the planet.



WILLY THE WORM This is a fast graphic game in which you try to get Willy the Worm home. It's extremely strange.

\$19.95

VOLUME 23

ARCE A really tiny archive utility, this thing will extract members from ARC files without tying up half a disk for itself.

BABY An extremely warped game, this thing is engaging and fairly challenging none the less. It involves catching babies who are leaping out of a burning building.

CHMOD This is a useful utility for reading and changing the bits in a DOS mode flag.

CITYDESK This is an elegant fancy printing program that allows you to do some desktop publishing functions with a dot matrix printer.

DOG A disk organizer, Dog will defragment the files on your disks to make them quicker to access.

FPR This is a printing program written in C. It's not compiled — you can change it to meet your needs. Requires a C compiler.

THRILL There is little to say about this program. It's a beautiful example of high resolution PC graphics, and was too good to ignore, even if it was wholly useless. It's also a bit naughty.

MIDI-IO This is the source file for the interrupt driven MIDI communication module from the April 1987 edition of Computing Now! Requires MASM to assemble and a language compiler to use — preferably C.

PC-WRITE The latest version of this phenomenal word processor, this thing is enough to turn you off any other word processing package on the planet.

will tell you where it is.

ASC This is a memory resident utility that pops up a window with an ASCII character chart.

ATTR This utility lets you meddle with the attribute bit of your files.

BAC This is a disk backup utility that is much less frightening than the one that comes with DOS.

BACKSCRL This recalls stuff that has scrolled off your screen. It's neat if you can't seem to reach the NumLock key in time.

CAT This is a collection of disk utilities in one program.

CLOCK One of the nicest clocks we've seen, this has a built in alarm function among other things.

COVER This is a sorted disk directory that prints out all the files on a floppy in a form suitable for sticking to the sleeve.

CWEEP This is a menu driven file mover — saves typing the word COPY over and over again.

DDIR Yet another directory utility, this does a two column directory similar to the regular single column DOS version.

DELZ This wipes out files so they can never come back — kills the sectors as well as the directory entry.

DISKSCAN This one checks your disks for bad sectors — get 'em before they get you.

DOORS This lets you flip between multiple monitors without rebooting your system.

EQUIP This program tells you what hardware your system thinks it has — often providing you with the answer to many software problems.

FASTDISK If your floppies seem a bit tedious, you might want to zap 'em with this speed up program.

FDATE This changes the date stamps of files.

FLIP This one sets a number of otherwise tedious parameters under DOS.

FREE This returns the amount of free space on a disk without having to watch the whole directory scroll by.

GERM This is a memory resident interrupt driven communications terminal.

IBMSHELL This allows you to fool your system into loading COMMAND.COM from other places.

KBBUFF This is a keyboard buffer extender. No home should be without one.

VOLUME 24

AC This is a small area code program — give it a three digit area code and it

VOLUME 21

CACHE A disk cache program allows one to vastly speed up the disk access of a PC by stashing frequently used sectors in memory. This public domain cache program is extremely fast and fairly intelligent about which bits of oxide it retains.

COREWARS Perhaps the first program to truly embody the spirit of the phrase "computer game", Corewars pits two programs against each other. The object of the game is to crash the other code.

EMACS This is the latest word in well-executed programmer's text editors. It has multiple windows, macros and will even create a DOS shell for you so that you can skip out for a while to execute another task. Requires NANSI.SYS (see below).

MTS lets you run two applications, flipping back and forth between them at the stab of a key. This is the first one of these things we've seen that's bug-free.

VIEW This is the fastest full screen file browser in creation. It allows you to page back and forth through a file — it's much slicker than the DOS "TYPE" command. Requires NANSI.SYS (see below).

NANSI.SYS A replacement of ANSI.SYS, the improvements in the performance of your system that NANSI can produce are almost god-like. It includes a high speed screen driver and additional escape sequence screen handlers.

MIDIzap Figuring out the secret codes that drive some of the more sophisticated MIDI instruments is a lot easier if you have something to send and receive them with. This little

MACSHOW This program allows you to look at Macintosh MacPaint image files on a PC. It will also print them and convert them to PC compatible bit maps. Several sample pictures are included. Requires a colour card.

\$29.95 (2 disk set)

KEYFAKE This allows you to "stuff" keyboard characters into an application to get past tedious introductory screens and menus.

LC This counts the number of lines in a text file.

LOCATE This scans through sub-directories, checking all the files for specific text strings.

LOCK This is a file encryptor. Also includes **UNLOCK**.

MOVE This moves files between sub-directories with less typing than **COPY** would entail.

NDOSEDIT An updated version of regular **DOSEDIT**, this is a resident DOS command line editor that actually makes DOS decent to work with. Indispensable.

NO This is a strange little wild card exception thing. It allows you to create more complex file specifications than does DOS all by itself.

NPAD This is a simple memory resident node pad.

PCUTIL This is a collection of add-ons to DOS.

PINHEAD This is the printing press program from the June 1987 edition of Computing Now! It can get up to 16 kilobytes of text on one page. Includes the C source code. — works with Epson compatible printers.

POPCAL This is a memory resident utility which will bring up any month of any year you like.

PR This is a handy formatted printing utility.

PUSHDIR Primarily used in batch files, this allows you to change sub-directories, do something and then return to the previous directory.

REBEEP A replacement for **PAUSE**, this is a noisy batch file utility to attract attention when a task has been completed.

RENDIR This renames sub-directories.

SCRN This is a screen saver — it blanks all the monitors attached to your system after a specified period of inactivity to keep your phosphor from getting fried.

SETPRN This allows you to painlessly set up your printer from DOS.

SETUP This is a memory resident utility that will allow you to set up an Epson compatible printer from within any application.

SIZE This returns the number of allocation clusters a file occupies on the disk.

SOUND This makes weird noises to attract attention from within a batch file.

SP This is a really nice little print spooler.

SWEEP This allows you to execute a 4-command in every subdirectory on your disk.

UNDEL This recovers accidentally deleted files. You may not need it now but you sure will sooner or later.

VDL This requests verification before it deletes files so you won't need **UNDEL** quite as often.

VOLSER Changes the volume name of a disk.

WAITN This pauses for a specified time while executing a batch file.

WHEREIS This finds files in sub-directories. It includes the C source code from the June 1987 edition of Computing Now!

XDEL This is a menu-driven file deletion utility.

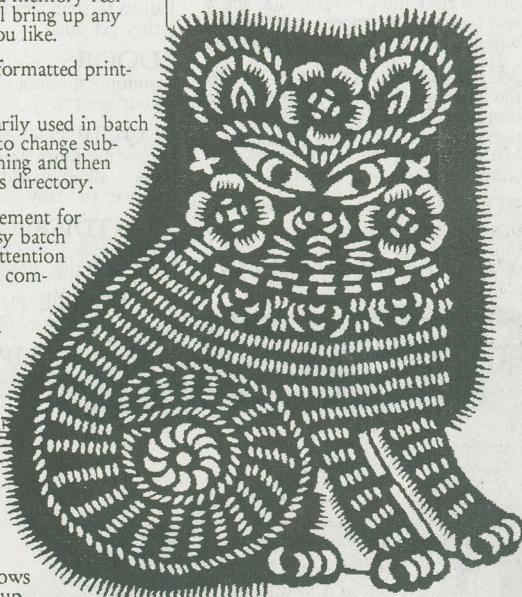
\$19.95

VOLUME 25

VMAC4 This little program allows PC users with Hercules compatible cards — or ATI multiple monitor boards — to look at MacPaint pictures. The Herc card has a more usable aspect ratio than the colour card, and the images look pretty slick.

PINBALL3 The weirdest pinball game we've encountered thus far, this thing will zap your brain if you play it late at night.

MAXHEAD This is a MacPaint



picture of Max Headroom for **VMAC4**, above. There are several more — rather more exotic — pictures on Volume 24, which will also work with **VMAC4**. Likewise, this file will work with the MacShow colour card program on the disk, which can be used to convert it for use in other PC graphic software.

SPKR A device driver, this little beast allows you to make the PC's speaker play music in a very elegant, program independent way. It's suitable for use with BASIC, C, Turbo Pascal, assembler and even just from DOS.

RESQ can recover erased files and, more important, it can find text that you've lost in memory due to a

software crash and get it back into a file. It's indispensable.

IT The "Ideal Terminal" is a telecommunications terminal package which emulates several professional mainframe style hardware terminals. It also handles XMODEM and KERMIT file transfers, making it a much less freaky replacement for the likes of QMODEM and CrossTalk.

RIGHT HAND MAN is a sort of enhanced public domain Side-Kick. It provides all sorts of pop-up utilities including an ASCII table, a really powerful calculator, a DOS shell and several note pads. It also handles keyboard macros.

SLOWDOWN A lot of software — mostly games — which has been written to run normally on a PC switches into maximum overdrive on an AT or even a fast PC. This usually makes it useless. The slowdown program allows you to bring the speed of such a machine back down to sub-light levels for these occasions.

\$19.95

VOLUME 26

AWS Programs that turn WordStar into ASCII abound, but this one turns ASCII back into WordStar. Let those high bits roll.

BADCLUST This program finds the bad clusters on cheap disks, preventing them from killing your data. If you must use low rent oxide, use it carefully.

CHEAPFMT Like **BADCLUST**, above, this program makes your life less freaky if you use cheap disks. It formats them very carefully, looking for unusable sectors.

CCC A C language programmer's dream, this is a "pretty print" program, that actually draws nesting loop and structure diagrams beside the source code it lists. It makes spotting even subtle bugs effortless.

CTP Something of a mutated fusion between snake and space invaders, this is a ruthlessly fast arcade game in first rate high resolution graphics. Requires a colour card or **HGC**, below, and a Herc board.

HGC This is the first colour card simulator for a Hercules board that really seems to have its act together for the majority of colour card graphics software. Run it and your Herc card will display colour card high resolution graphics as if it was designed for the task.

BIGPRINT This program prints text files in very large characters. It requires an Epson compatible printer.

MBS This is one of the nicer fractal programs we've encountered, as well as being one of the faster ones. It runs on a colour card, or on a Herc board with **HGC**, above.

MOUSE This is the source code for the linkable **MOUSE** driver, as seen in the July 1987 edition of Computing Now! It requires MASM to assemble and a C compiler to use.

PCRR This is one of the most interesting programs we've yet en-

countered. It simulates a railroad in high resolution graphics. You can lay out your railroad, equip it with multiple trains and make the whole party go. Requires a colour card or **HGC**, above and a Hercules board.

TASKER This is the most elaborate multitasking system yet devised for the PC. Install up to nine variable sized partitions, with a program running in each, and pop between them instantly.

WINDOW This is the source code for the C language window manager from the July 1987 edition of Computing Now! Written in Lattice C.

\$19.95

VOLUME 27

DECEIVE This is a resident program to be used if your boss likes to creep up behind you when you're supposed to be working. At the touch of a key your PacMan screen can be replaced by WordStar, Lotus or any other serious application until the powers that be are satisfied and play can resume.

DPATH Allows the opening and creating of files to be handled with a path, just as the running of programs is under DOS with the **PATH** command. This is the gift of the gods to programs that can't find their overlays and configuration files.

HXC A sophisticated hexadecimal calculator, this program will keep you from damaging your hands by trying to glue on four extra fingers.

IMON This is a resident utility which monitors the disk I/O of your system and lets you see what the drives are doing. It's great for spotting the causes of system errors.

TREECOPY This is the best... and fastest... tree copy utility we've encountered to date. It will copy an entire subdirectory and all of its included subsubdirectories into another tree.

TREEDEL This program will wipe out a whole subdirectory and any sub-directories in it with one command. Mass slaughter... what fun!

TREESIZE This program tells you how much space is occupied by the aggregate contents of a subdirectory.

VRAM This amazing bit of work is for people with programs that want to see a Lotus-Intel AboveBoard memory card... if they lack one. It allows up to eight megabytes of hard drive space pretending to be extended memory... sort of a reverse RAM drive.

LQPRINT is a nice print enhancement utility that works with many word processors and printers. It includes a wide selection of very well done fonts.

ZANSI Another replacement for **ANSI.SYS**, this one increases your console printing speed by almost fifty percent without sacrificing any of the commonly used **ANSI.SYS** functions.

CYDON This makes your cursor go strange... deliberately. Requires an EGA card.

EGAROIDS The best asteroids

game ever written for the PC... when those rocks come at you, pray to the cosmic gods. Requires an EGA card.

KC-PAL An EGA palette editor and librarian. Comes with lots of support utilities and toys. Not surprisingly, it requires an EGA card.

NEWFONT Replace the austere, depressingly corporate IBM font of your PC with damn near anything you can think of. Several fonts are included. The screen interface is seamless, and the results can be extremely pleasing. Requires an EGA card.

\$19.95

VOLUME 28

ASTROLAB This is a very sophisticated program for working out the conjunction of the planets for any day in history. It's not much use if you believe in a flat earth, but handy for horoscopes.

BASERES Yet another resident utility, this thing will accept numbers in any base and show them to you in all the other commonly used notations. In other words, it will convert decimal to hex and back again—great for people with only ten fingers.

BREAKON This is a utility to make just about any program exitable with control-break. It has multiple levels of urgency—three hits gets you out of anything short of the end of civilization as we know it. Assembler source included.

CROSSWRD If you've ever wanted to generate your own crossword puzzles, this is the code for you. Fill it full of words and it finds places for them—keeps track of the clues, too.

DIMMER The smallest screen blunker yet—two hundred and seventy one bytes.

EPSONISM Even people with laser printers occasionally have to deal with plebes. This program is a DOS filer to make a PostScript printer behave like an Epson.

FASTBIOS This is a pair of programs which will extend your keyboard buffer—without hanging your system—and increase the speed of your screen dramatically.

FREERAM This will tell you the truth about how much useable memory is available to your programs.

LASERGRID This is a rather good ASCII game. Place your bets and hope the aliens leave you alone.

VMUSIC This is a small three voice music player which handles its scores in BASIC music notation. Comes with several songs, and you can easily create your own tunes with a text editor.

IDCKEYS This is an assembly language program to set up the function key redefinitions under ANSI.SYS. It's great if you like to have keyboard macros under DOS without a keyboard redefinition program installed. Requires an assembler to use.

IDCKILL This will go through an entire hard drive—including all your

subdirectories—and kill files that match a given specification. A bit nasty if you use it improperly, but great, say, for snuffing BAK files.

LW86 This is an extensive pop up reference card for assembly language programmers. It includes explanations of the op codes, what the assembler directives do and so on, all at the touch of control shift.

SPACE Find out how much useable space is on your hard drive instantly. Includes assembly language source.

YESNO A really useful thing to create complex interactive batch files, this little program returns an error level code basic on the ASCII value of a key press. Assembly source included.

\$19.95

VOLUME 29

INSTACALC is a memory resident spreadsheet. It may not be Lotus or Excel, but it's amazingly powerful considering that it lives in an alternate key combination. Includes a sophisticated macro facility.

ALTER allows you to change the attributes of a file... including the time and the date.

CALENDAR is a sophisticated desk calendar which can be made memory resident if you want it to be. It uses data files which allow you to have it remind you of things.

COVER prints disk directories suitable for sticking into the sleeves of your disks... the nicest such program we've encountered. Requires an Epson compatible printer, patchable with DEBUG for other printers.

DISKLITE is a tiny bit of code which shows you when one of your drives is running. Not much use for floppies, this, but great for RAM disks and AT style internal hard drives.

DISKUTIL is a poor man's Norton utility. It will walk you through simple disk level functions, including FAT table fix ups and file unerasure.

MELT clears the screen, dramatically.

MONSTER a memory resident DOS monitor. Check out what your programs do one INT 21 call at a time.

THEGRIN is the most sophisticated MacPaint picture viewer yet. It allows you to stretch and compress images, zoom in and out and generally hack their bits to bits. It also prints them.

TMAP is a clever TSR program mapper which is itself memory resident. It's superb for finding gorchies caused by interacting resident programs.

VARISLOW is a variable speed control for AT type computers. It lets you crank the clock down to play games at their normal speeds. However, you can do it interactively, rather than from a command line.

WATERFALL is a fabulous MacPaint picture of an Escher drawing, suitable for use with THEGRIN or any other MacPaint reader.

CHINASEA is a James Clavell novel in a disk file. In this game you get to be a trader in the far east. Try to prosper without getting knifed.

TURBO C PATCHES is a collection of patches to fix some of the bugs in the early releases of Borland's Turbo C. If you're going to compile at warp speed you'd better have one of these.

\$19.95

VOLUME 30

386BUG Some 80386 chips don't

work quite right. They have problems with integer multiplication, which can cause some software to behave unpredictably. This Little program spots the duds... it's essential if you're thinking about buying a 386 machine. Includes source code.

MASM-MAC This is a collection of MASM assembler macros to make BIOS, DOS and 8087 interfacing a lot easier. Requires MASM to use.

8X6 installs a really tiny screen font on an EGA card. You can get about four times the usual amount of text on your screen with this if you run applications which support it.

AT is a little time bomb program. It will hide in memory and run applications at specific times and dates without any attention. Allows for queuing up several tasks.

BACHMIN is a three part Bach minuet in BASIC... quite the trick.

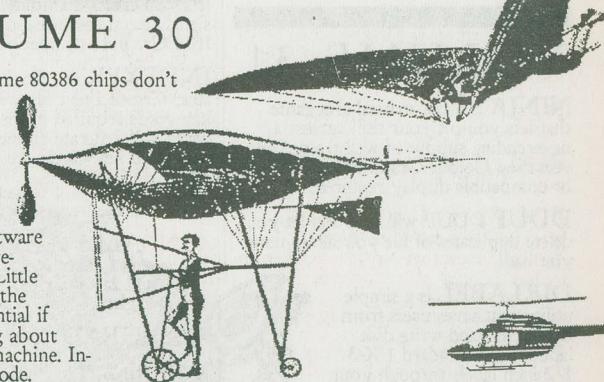
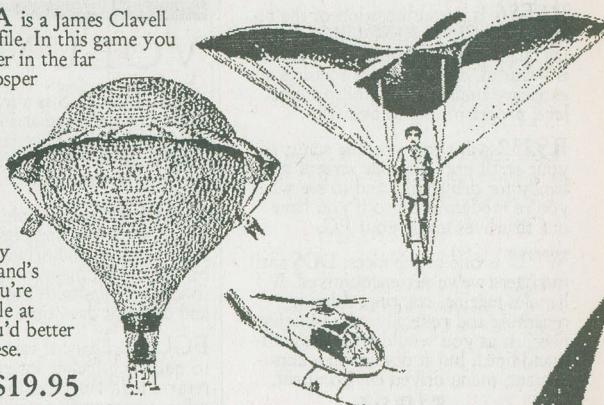
CAT is a small sorted directory program. While hardly high tech, it is a useful replacement for DIR.

CAVERNS is a fast graphic arcade game. It looks a bit simplistic but it will surprise you when you get into it. Wants a CGA card.

CMOS is a pair of simple programs which read the contents of an AT's CMOS memory into a disk file and then restore it. This is great for changing batteries, of course, and also for those systems with funky memory which require frequent setting up.

DIRNOTES allows you to attach short, one line comments to the directory entries on your disks.

PRTSCEGA is a program to make the PrtSc function work properly for EGA cards, allowing you to once again dump screens to your printer. Versions are included for a stock Epson FX-80 and for the Tandy DMP200. In addition, the source code comes with it, so you can hack a driver up for your specific printer.



EDISK allows you to put a RAM disk in the space between your normal system memory and your screen buffer, using this otherwise wasted space for something practical. It requires that you have memory in there, of course... many RAM cards will do.

EMC is an extended memory cache. It allows you to use LIM memory for a disk cache, speeding up your disk accesses without robbing your system of any main memory.

GDIR is a sorted directory program with uses the Hercules card's graphics mode to put forty-three lines of listings on the tube at once. It's very slick.

HELP is a slick little DOS help program which can be called up any time you need something about the PC explained to you.

THRASHER is a splendid system to find out the optimum setting for the BUFFERS line in your CONFIG.SYS file. It can speed up your disk accesses while actually freeing up a bit of memory.

MCSSCOOP is the executable version of the MacPaint file reader in the Jan. 1988 edition of Computing Now! It also prints picture files... to PostScript, LaserJet + and Epson printers.

LDRES is a system to make somewhat standard COM files into memory resident utilities, or TSRs. Please note that while full documentation is included with this thing, it's still a bit technical and you'll have to be a moderately decent hacker to make something come of it.

NOREBOOT will disable the Ctrl-Alt-Del reboot of your system. Source code is included.

RES86 is a transliteration of the redoubtable CP/M RESOURCE machine language disassembler. Source code is included. This program requires an extensive understanding of machine level programming to be useful.

RS232 will show you the status of your serial port on your screen. It's handy for debugging, and to see what you're modem is up to if you have one that lives inside your PC.

WFU is one of the nicest DOS shell managers we've yet encountered. It handles tagging, copying, deleting, renaming and generally manipulating files just as you would with the command line... but it does so in a convenient, menu driven environment.

\$19.95

VOLUME 31

NINJA is a fast martial arts game that lets you pit your skill against a neverending supply of well trained adversaries. Colour Graphics Card, EGA or compatible display required.

DDUP DDUP will find and let you delete duplicates of file you never new you had!

DIRLABEL is a simple utility that saves users from having to hand-write disk labels. Feed standard 1 X 3 1/2 inch labels through your printer and start DIRLABELing your floppies.

MADNESS If you thought you were going crazy, you haven't played Madness. MADNESS is an adventure game for the mind. Enter a land of shadows and mirrors, where reality is little more than a hazy concept.

PM is a handy co-resident phone message utility. Just pop PM onto your screen and enter the particulars of each call. PM inserts the correct date and time and appends each message to an ASCII text file that can be printed later.

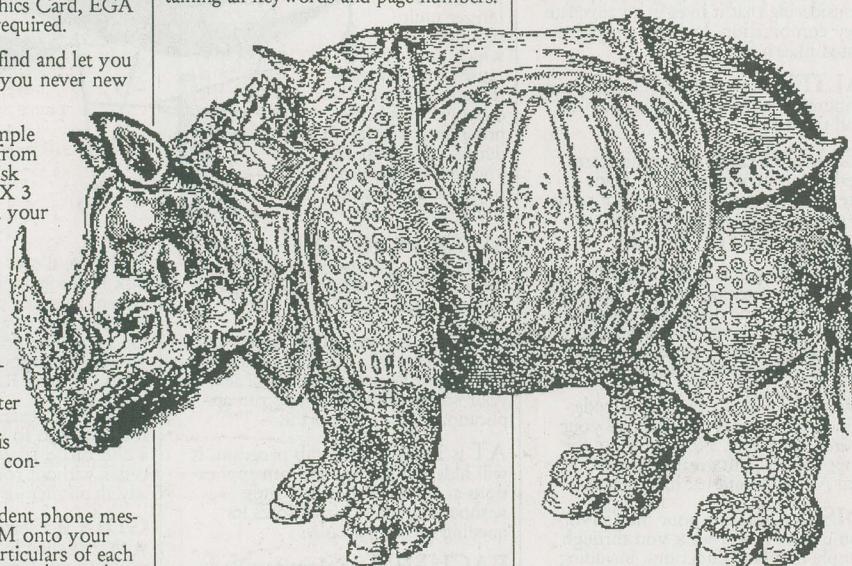
RUSHHR is one of the strangest games ever created. Play traffic computer by juggling the timing of a series of traffic lights in a busy downtown core. You control the number of cars that are able to get through each light.

SPEED performs a detailed system speed test - similar to the "SI" test provided on the Norton Utilities, only better. SPEED shows you speed statistics for a host of register and memory operations such as arithmetic calculations and block memory reads and writes.

FREECELL This is an unusual solitaire game. Great graphics!

HDSENTRY is a resident utility that intercepts destructive calls to hard drives. Run HDSENTRY before trying out public domain software of dubious origin. It tries to prevent Trojan software from destroying the data on your hard drive.

\$19.95



VACINE is a utility designed to prevent "virus" software from infecting your hard drive and DOS disks. VACINE can tell you if the COMMAND.COM and DOS system files have been tampered with.

FREE is a memory utility which reports on how much RAM is available in your system. This one also reports on Extended Memory (above 1024K).

PRUFREAD is a specialized file browser designed to speed proofreading. A highlighted bar remains stationary in the middle of the text screen, making it easy to focus on one line at a time in the text.

FKEYMAP is a utility for printing Function Key templates (for keyboards with function keys vertically oriented on the left-hand side). Great for new users. FKEYMAP includes templates for Word Perfect and Lotus 1-2-3 version 1A.

APRIL is one of the strangest "April Fools" software pranks ever created. Slip it into a friend's AUTOEXEC.BAT file and see what happens. Completely harmless fun. Colour graphics

card required. Also works with SIMCGA CGA simulation utility.

DVICEMAP is the most comprehensive utility yet devised to map memory locations of DOS system devices. This one also shows the order in which devices have been loaded, attribute words and interrupt locations.

\$19.95

VOLUME 33

READRITE is a co-resident "readability checker". Based on a formula developed by Rudolph Flesch, READRITE can be called up to analyze text. It will provide a readability index that relates syllables per word and words per sentence.

SPACEWAR is a fantastic space battle simulation. It comes in both CGA and Hercules versions and has stunning graphics and fast play. Loads of options!

MFRAC is a simple fractal gener-

ator that can display an endless variety of "mountain" fractals. CGA required.

TCKILL is a file deletion program with a twist. After files have been OK'ed for deletion TCKILL will toss them into the trash!

TETRIS is a wonderful game! This is the original version that was created in Russia. It is best described as an "action puzzle" and it will challenge your imagination and your reflexes for hours at a time.

TOGGLE is a useful little utility that lets you control the status of your keyboards NUMLOCK, CAPS LOCK and SCROLL LOCK keys from DOS.

STOPCLOK is a handy little stopwatch that prints a huge digital display on your screen. Just the thing for the office olympics or for the occasional impromptu benchmark.

LIFE is a new version of a classic computer game. This one comes with complete on-line instructions and includes a detailed history of the game.

BUFFIT is a nice DOS buffer utility that lets you scroll through DOS screens that have disappeared from view.

ELTYPE is a simple typing test program for training and evaluating keyboard virtuosos. It provides real-time statistics on speed and accuracy.

\$19.95

VOLUME 34

DA is a multi-featured directory sorting utility that allows you to arrange DOS "dir" file listings in any order you please... program files at the top, data files at the bottom, yogourt on top, fruit on the bottom, you name it.

IAU is an invaluable hard-disk Interleave Adjustment Utility. It allows you to reset the "interleave" value of your disk, without disturbing your data. If your drive was set up by uncaring, unfeeling mechanics at the dealership, chances are you can double its response speed.

HDTTEST is a very complete hard disk testing system. It writes and reads several types of test patterns on every sector of your drive, and will find subtle data weaknesses to faint for DOS to notice. Data is removed from suspect sectors, and the sectors marked as bad, so DOS will avoid them in future.

G uses a little data file to store "nicknames" for commonly-used directory paths. By running G followed by the nickname, you can immediately switch to the desired directory — no matter how distant it may be in terms of DOS path specs.

FLUSHOT is one of the most respected anti-viral protection systems ever devised. The program provides checksum protection of system files, immediate warning of any programs that try to leave portions of themselves behind in memory, and warnings any time a program attempts to do direct writing to your hard disk. There are numerous other options, plus very extensive documentation.

\$19.95

VOLUME 35

SCANNER is a goldmine of information for anyone interested in broadcasts you can't get on an AM/FM Walkman. SCANNER provides Canadian, American and world-wide (where applicable) frequencies for aviation, marine, NASA, news, weather, railroad, taxi and myriad other services.

BCALC41 is a Big CALCulator which will delight anyone who requires miles of precision for their calculations. BCALC41 can calculate pi (or any figure) up to 1075 digits with blinding speed, emulates a Hewlett-Packard calculator with numerous functions, ten memory and four stack registers, and is accompanied by its C source code.

CWC is a remarkably thorough crossword puzzle designing tool whose output actually looks like a crossword puzzle, clues and all. Save and load your puzzles to disk, and edit or print them out at your leisure. Fair warning: the demo puzzle's a killer. Needs an Epson-compatible printer, but any video card will do.

FORMATQM is a practical ... and speedy ... solution to the nightmare of formatting an entire box of diskettes. FORMATQM easily handles all IBM PC and PS/2 disk formats. Though designed to format many disks in one sitting, it can format a lone 360K data disk in 41 seconds flat.

ANADISK is a comprehensive floppy disk aid which, among other things, will copy most disks. DISKCOPY has problems with, allows editing of sectors or files in hexadecimal or text, and will endeavor to fix corrupted FATs and remap bad disk sectors.

ANADISK reads most combinations of IBM disk formats, and can even read Atari ST 3.5" diskettes (this assumes you have an AT with a 3.5" drive) ...

UNERASER will resurrect accidentally erased files, providing they haven't been written over by other data. This small but vital program is extremely handy should you DEL one file too many.

\$19.95

VOLUME 36

FINANCE1 was written to keep track of the home chequing account, and allows both known and estimated (what if?) entries. Charts may optionally be generated of annual income and expenditures.

FORM275 uses IBM's graphics characters and comprehensive editing functions to make designing forms as easy as drawing them on the screen. It comes in handy for drawing street maps and decorative borders, too. Forms may be printed on printers which have the IBM graphics set in ROM, or saved for importing into database programs.

TELEPORT is a snazzy bit of

RAM-resident coding which enables you to capture, edit, merge and save up to four text windows simultaneously with a monochrome, CGA or EGA card.

ONSIDE will take spreadsheets saved in ASCII format and print them sideways on an Epson-compatible printer. While that's not an original concept, ONSIDE allows you to choose from seven inherent fonts, which may be magnified in two directions. You may also elect to modify the available fonts or fashion your own. ONSIDE can print lengthy sheets, and will use either a monochrome or colour video card.

WS161 actually isn't another WordStar upgrade, but an exercise in surviving in the wild. Find food and shelter in a forest that has little interest in your leaving it alive. CGA card required. Surprisingly addictive, it beats blasting acquaintances with paintballs any day.

\$19.95

VOLUME 37

OPTIKS is a welcome solution to the amazing proliferation of varied ... and incompatible ... graphics formats vying to become the de facto standard. OPTIKS can read and

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VOLUME 39

BOOM is a program to display fireworks on your screen. You probably don't think you need one of these... most likely true, but it's fun to watch. Requires a CGA or EGA card.

COLORDIR is a very slick... and exceedingly fast... sorted directory program which uses screen colours to make large directory listings easier to out at a glance. A colour monitor, while by no means essential, is highly recommended.

DIGCLOCK is a huge screen clock which reads out in seven segment numerals. Easily read from across the room, or across the street with a good telescope.

DISPINFO is a C source file for programmers. It's a foolproof routine to allow your code to figure out what sort of video card is in the computer it's running on.

ED is another C source file, this one for the standard unix ed text editor. It has been reworked to compile under Turbo C, and will serve nicely as the basis for a word processor if you want to write your own.

EGA2RAM runs the BIOS of your EGA card from fast RAM rather than slow ROM. It speeds up your screen quite noticeably with no snow or other drawbacks. Requires an EGA card, ASM source code included.

FASTGIF is a GIF image file reader. GIF files are glorious colour picture files which must be seen to be really appreciated. We've included a GIF file of a mandrill so you can see what they're up to. Requires an EGA or VGA card.

HP-SLASH reduces the size of LaserJet soft fonts... and their resultant download time... by allowing you to selectively remove unused characters from them. This is an essential tool for anyone using a LaserJet compatible printer, especially with desktop publishing.

MAXI.EXE is the answer to every "insufficient disk space" message in creation. It formats up a normal double density floppy to hold four hundred and

twenty kilobytes, and a quad density disk to hold almost a megabyte and a half. Our tests indicated that these disks are no less reliable than normal floppies, and can be read in normal PC drives.

PC-POOL is a really well executed pool simulation. The ballistics of the balls is very nearly perfect, and the user interface is well thought out. It's not as gory as killing aliens, but it's better for your karma. Requires a CGA or EGA card.

REMINDER is a memory resident appointment calendar which pops up at the touch of an alternate key. It also features a screen clock which can be enabled or disabled at will.

RN is the best way to move around the subdirectories of a hard drive ever invented. Rather than having to type in complex paths, RN allows you to move around in menu driven comfort.

SAY is the best speech program we've encountered for the PC thus far. It's pretty intelligible, especially considering that it speaks through a speaker the size of a quarter connected to a timer chip. It comes with a host of phrases, including the all but essential "beam me up, Scotty". Good for disturbing your stupor in the morning.

VFM will warm the hearts of Ventura Publisher users. It allows you to add and reorganize fonts for this popular desktop publishing system without any sweat, bother or keying of batch files. No laser should be without one.

MCOPY is command line replacement for the DOS COPY command which allows you to copy files to floppies with maximum space efficiency, a prompt to swap floppies when the disk is full and full CRC checking to make sure that what you see is really what you get. DOS, as it turns out, doesn't verify its copies very well even with the verify flag on. This is an essential utility.

\$19.95

VOLUME 40

SQUYNCH is an adventure game created with the Adventure Game Toolkit. Charged by Squeeb II to retrieve his ruby, you'll face various unpleasant obstacles in fulfilling his request. SQUYNCH has a sophisti-

cated command parser which accepts complete sentences as valid input.

CRAPS is a realistic representation of the Las Vegas dice game. CRAPS' instructions include a thorough description of how the game is played and the odds of various bets paying off. You'll need a colour graphics card and ANSI.SYS in your CONFIG.SYS file to play.

PICEM16D allows users of CGA, Hercules and EGA as well as VGA graphics cards to view multi-coloured .GIF, .PIC and .PCX graphic files. Plantronics and AT&T graphics cards are also supported.

ROGER.GIF is a multi-coloured graphic of Roger Rabbit, a cartoon hare of recent cinematic fame. Best viewed on a colour monitor.

EDMAC allows users to edit and (optionally save) readmac graphic files. Good for cleaning up the extra bits inherent in files ported from the Macintosh. EDMAC is accompanied by its Pascal source code, and requires a colour graphics card.

OPUS is a readmac of Berke Breathed's Bloom County character in a questionable state of Penguin Lust ...

FOWLPLAY attempts to settle the question of why did the chicken (or turkey) cross the road. Similar to Frogger, this game requires a colour graphics card.

ATALK is a number of humorous digitised sentences which actually sound reasonably clear through your speaker.

\$19.95

VOLUME 42

FORMATQM is a very, very fast disk formatting program.

FIREWORK blanks the screen after a period of inactivity and shows you fireworks until you do something. Windows is required.

SNAKE is simply the best snake game every written.

BELL makes the sound of the beep in your computer slick and sophisticated

CALLTIME will dial up the atomic clock in Ottawa and set your system clock accordingly. A Hayes compatible modem is required.

CASE will change a text file to all upper or all lower case, strip of the WordStar bits and do other useful things.

CDTO provides a simple way to locate files in other subdirectories and the go to their locations.

CLOCK is the biggest resident screen clock in creation.

DDATE is a cursor driven date setup program.

DEV shows you where all the device drivers in your system are.

KTIMER times the execution of any program to the nearest 100th of a second.

LISTFRAG shows you how fragmented your hard drive is, allowing you to decide whether it's worth running a defragmenter program.

MAPMEM let's you see what's where in the memory of your system.

NREFRESH slows down the refresh rate of your system memory to increase the speed of your machine.

RAMVIEW is a resident program that lets you pop into a hex and ASCII dump of your system and page through your RAM. Very revealing.

REPEATS locates identical files in a complex hard drive system, allowing you to free up disk space.

SETALARM wakes you up at a predetermined time.

SILENCE more or less totally kills the speaker of your PC.

STEPDOS allows you to step through the execution of a program one DOS call at a time, with an informative display at each pause.

VTREE2 shows you a map of your system and the sizes of your subdirectories. Great for pruning.

WATZITDO returns information about the multifarious alternate key combinations on the PC.

WF is a very clever wild card find program that searches for files on your hard drive without asterisks or question marks.

WORLDTIM lets you see the time anywhere in the world.

WPHD disables writing to your hard drive temporarily, protecting it from viruses to some extent.

XPANDISK creates a very sophisticated, variable sized RAM disk in expanded memory.

TUNEUP uses your PC's speaker to generate extremely precise pitches for tuning stringed instruments.

FORM generates business forms.

TCAP captures text screens, but makes them into GEM/IMG files

\$19.95

CLIPART

FOR PC AND MACINTOSH

If you have begun using the popular Ventura desktop publishing software package, you'll know how much graphics can dress up your documents. However, unless you have a scanner and a ready source of hard copy clip art at your disposal... or a paint box program and a great deal of time... it's very nearly impossible to find spot illustrations in picture files. At least, it used to

VOLUME 1

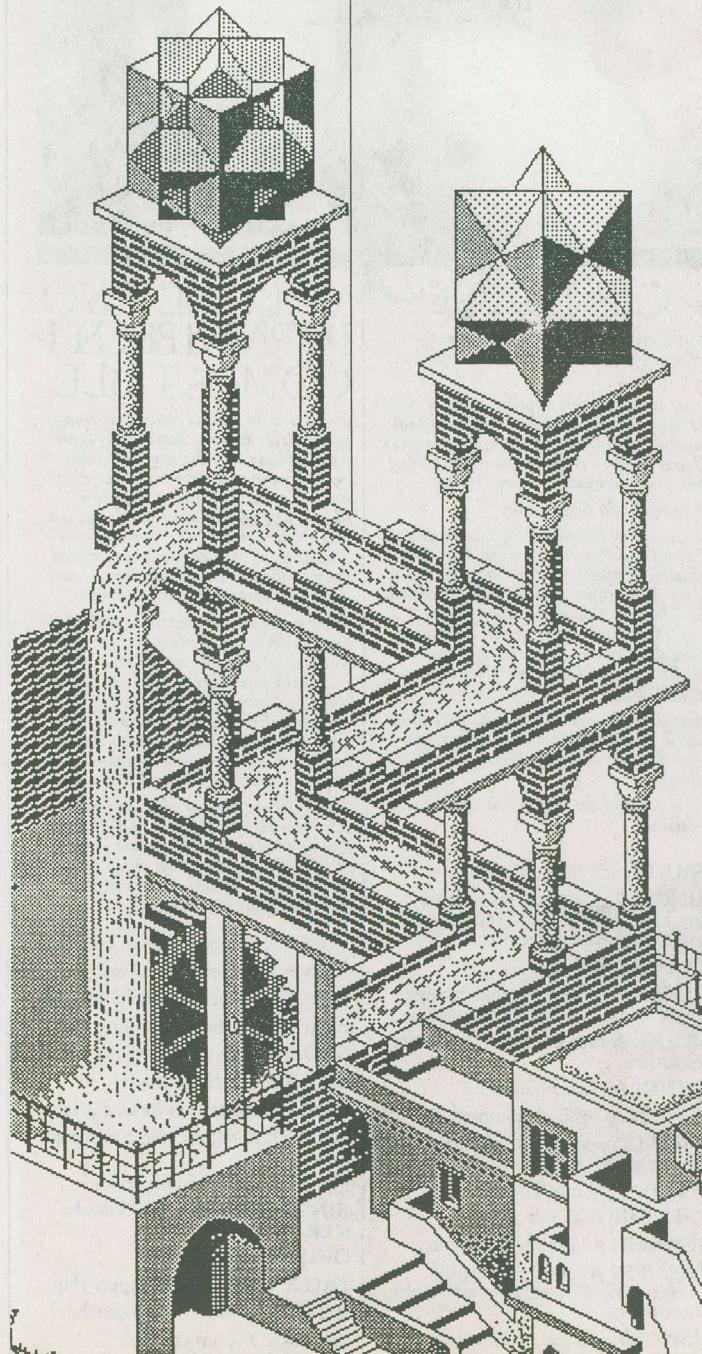
- BABY
- BELVEDERE
- BLUES BROTHERS
- BLUENUN
- BUGS
- CHEETAH
- CLIPART
- FISHES
- GIRLWING
- KNOT
- KOALA
- LETTER A
- HEARTS
- WOMAN
- RELATIVITY
- SCAN
- ESCHER WATERFALL

VOLUME 2

- AIRCRAFT
- BUTTERFLY
- CAR LOGOS
- COLLECTORS CARS
- MORE CLIP ART
- CUBE
- DANCERS
- DRAGON
- GLASSES
- GREYHOUND
- HANDS
- MORE KNOTS
- LEATHER GODDESS
- MINOTAUR
- SKELETON
- TIGER
- ANOTHER WORLD
- ZEBRA GIRL

VOLUME 3

- BADNEWS
- DRAGONS
- DREAM
- KIDS1
- MEN1
- WOMEN1
- MONALISA
- CAT
- RHINO
- TRIANGLE
- OLDMAN
- SHELL
- BEACH
- FLOWER
- PAISLEY



be. Almost Free Ventura ClipArt picture collections are disks full of image files. They will work with Ventura 1.1, and we include a utility to make them suitable for use with the original 1.1 release or the patched one. Each disk has a variety of pictures, both for spot illustrations and full pages. They're suitable for reproduction on any output device. Only \$19.95 each.

VOLUME 4

- BUDBRAIN
- DRAGON2
- SKULLS
- KIDS2
- MEN2
- WOMEN2
- PERSUIT
- SUNDIAL
- PORCHE
- EASTWOOD
- VANGOGH
- IBMWARS
- STELLA
- QUADRANT
- YAWN

VOLUME 5

- BIRD
- BOOP
- BORDER
- CLIPART1
- CLIPART2
- CONAN6
- COUPLES4
- DRAGONX
- ELEGANT
- HUNTED
- KIDS3
- KRAZICAT
- MEN3
- SCRAPS
- SCROOGE
- SPLINTR
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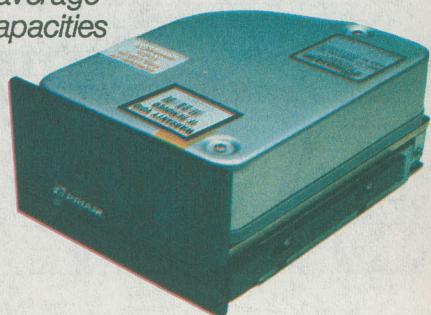
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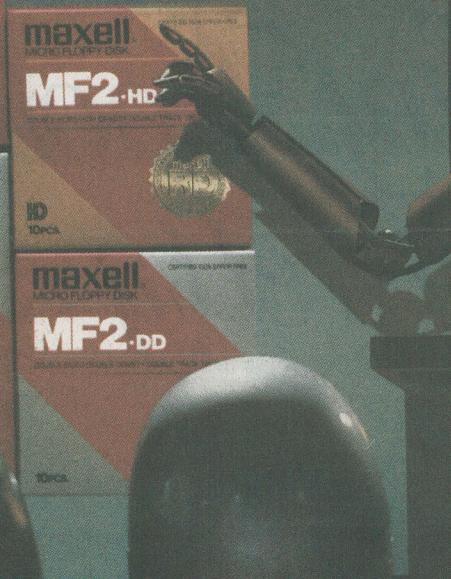
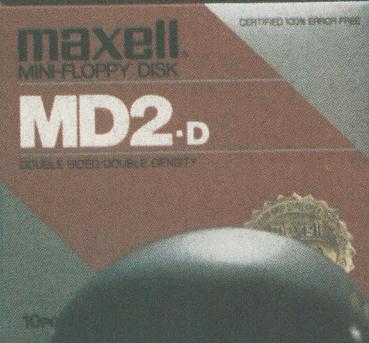
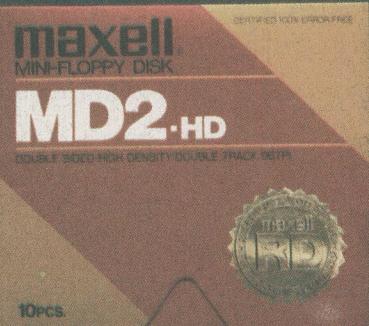
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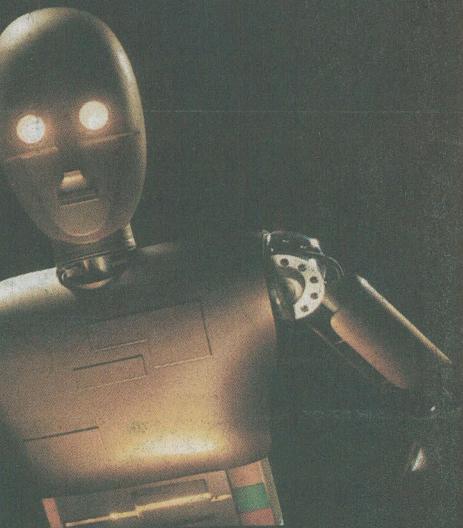
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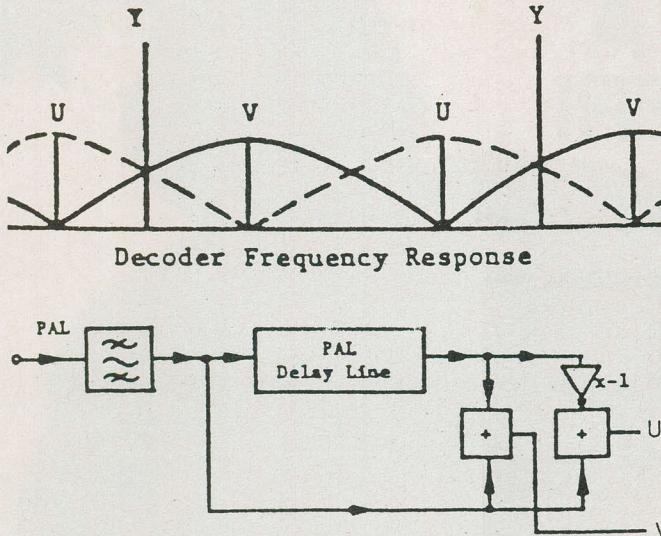


Figure 1. PAL delay decoder.

Digital Versus Analog Implementation

Although this article is primarily concerned with digital processing of television pictures it is necessary to be aware that some of the signal processing could be carried out using analog circuits. Hence, some consideration will first be given to the relative merits of the two processing technologies.

Analog does not require the use of Analog to Digital (A/D) or Digital to Analog converters and in general fewer signal interconnections are required. Modern analog integrated circuits are very stable and reliable but may require setting up/adjustment both during production and in service. They're more prone to crosstalk, noisy pickup etc, with performance tending to degrade slowly over a period of time. Lastly, they may not be suitable for large stores due to the accumulation of errors within the store itself (e.g. noise, nonlinearity). Digital requires A/D's and D/A's and many interconnections may be required. Video processing requires high data rates, so there is a possibility of interference with the receiver RF and IF circuits. Digital lends itself to automatic testing—self diagnosis can be built in. It also tends to fail dramatically.

Possible Uses of Stores in TV Receivers

The two types of processing expected to provide the most significant improvements to the viewed image are display standards

conversion and reduction of PAL decoding impairments.

These will be described in more detail following a general discussion of some of the possibilities for signal processing in the receiver using digital storage techniques.

Scan Rate Conversion

The conversion scanning pattern of 625 interlaced lines of refreshed at 50 fields per second (625/50/2:1) in the PAL system

results in a number of defects which may be readily observed in the final image. These defects are large area flicker, interline twister, line crawl and static raster visibility. The use of storage configured as a scanning standards converter so as to present the lines and fields/frames on the receiver cathode ray tube (CRT) at a higher than normal rate will result in the removal of some of these defects, depending on the degree of up-conversion employed.

Improved Colour Decoders

The conventional PAL delay line coder suffers from two main defects; cross-colour and cross luminance. These imperfections are caused by the inability of the conventional decoder to fully separate the chrominance and luminance components. Both luminance and chrominance are present in the frequency band around the colour subcarrier. A portion of the spectrum in the subcarrier region indicates that the chrominance and luminance could be separated by a suitable filter. Such filters can be designed using combinations of the line, field and frame.

Noise Reduction

A frame store can be used to reduce noise on static pictures by, for example, averaging coincident picture points of consecutive frames. Movement in the picture will clearly invalidate this process, but use may be made of the fact that the eye is not as sensitive to noise in moving picture areas. Recursive digital filters incorporating

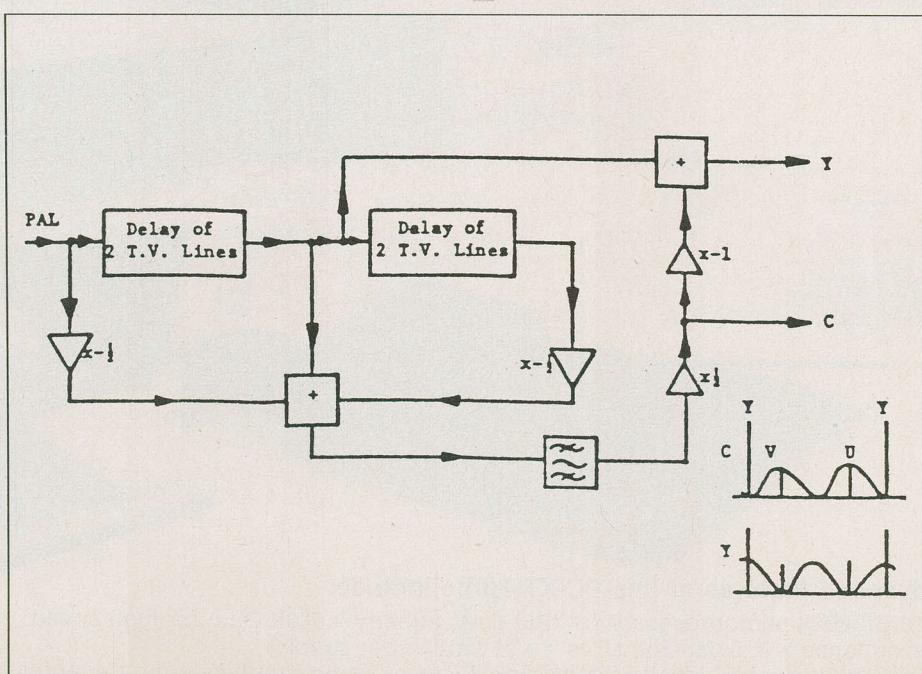


Figure 2. Decoder based on four line delays.

movement detectors can be designed to cope with both static and moving images.

Detail Enhancement

Transitions within the picture may be detected and their risetime decreased in order to improve the subjective picture sharpness. Horizontal transitions require only picture point delays.

Ghost Removal

The effects of multipath reception are usually seen as repeated, weaker versions of the main image displayed to the right of the required image. These additional images may be removed by the use of a suitable detector and associated delay line that provides a delayed attenuated, suitably anti-phase version of the input signal for the subtraction from itself so as to cancel out the ghost.

Freeze Frame, Picture in Picture

Stores may also be used to provide a range of special effects such as freeze frame and picture in picture. It should be noted that a freeze frame facility would provide a perfect still picture, unlike those currently available on many video cassette recorders.

Improved PAL Decoding

The basic configuration of the conventional PAL delay decoder is shown in figure 1, together with the frequency response, from which it may be seen that cross talk of luminance into the chrominance channel must occur. The separation may be improved by the use of line delay comb filters placed before the conventional decoder. A filter may be based on line delays. Figure 2 shows a decoder based on four line delays. The chrominance output of the comb filter feeds a conventional single delay line coder which performs the normal separation of U and V components. The luminance output is available for use directly and does not require the application of a chrominance notch filter since these components have already been removed by the filter. This means that a significant improvement is achieved in the luminance bandwidth available for display. That is, the luminance bandwidth is now limited only by the IF response of the receiver and not, as in the case with current receivers by colour coding considerations. These types of comb filters will only work for areas of plain colour in the vertical direction—the minimum size of the area being determined by the number of line delays being used. It follows then that

the four line decoder required a larger plain area than the two line decoder. If the vertical detail (horizontal transitions) is processed by these decoders than the luminance/chrominance separation breaks down resulting in the usual picture impairments. In order to prevent this from occurring, an adaptive version may be designed in which the signal differences across the delay lines are sensed and if these are greater than a certain threshold (used to prevent noise from interfering with the system), the decoder is switched into the conventional mode.

This type of adaptive decoder will work very well on moving images and moderately well on static images. However, comb filters based on either field stores or frame stores will provide significantly improved performance on static images. The filter action can break down on moving images due to the input delay and other output from the delay being somewhat different as a result of the motion. Thus, it may be necessary to consider the use of motion detectors, the output of which would be used to change the comb filter between field/frame operation and line operation.

Display Standards Conversion

The conventional 625/50/2:1 display scanning standard suffers several defects as previously indicated. The removal of these defects would result in considerable improvements to the displayed picture, especially as larger screens become available, on which these and other impairments would be more obvious. The modification of the display scanning may take several forms such as conversion to 625/60/1:1.

This technique would result in a sequential 60Hz display in an attempt to reduce interline flicker and faster visibility. Two possible means for achieving this conversion are line store conversion and frame conversion. A simple converter using only line stores to perform line interpolation can provide the additional lines required to make an incoming field into a full frame. This type of converter works very well in plain picture areas but fails in areas of vertical detail where the interpolation cannot correctly estimate the best information with which to fill in the additional lines.

For static images the optimum additional lines are to be found at the corresponding spatial position on the alternate field and at least one field of storage is required in order to make use of these lines. Frame store conversion can be

facilitated by interlacing a frame store to a sequential converter which contains a motion detector; the output of which controls the converter operation so as to use full frame data in static areas of the image and line interpolated data in moving areas. The performance of this converter depends critically on the design of the motion detector which in practice would not be simple.

Conclusion

The use of digital storage in future TV receivers will enable a range of sophisticated signal processing techniques to be employed in order to give significantly improved subjective performance of consumer receivers. It is envisaged that VLSI components will ensure that the cost of such processing is low enough for inclusion in consumer apparatus. Although it may seem that the resulting receivers will be vastly more complex, in practice the use of digital techniques and correcting procedures are expected to result in a more stable and reliable overall performance. ■

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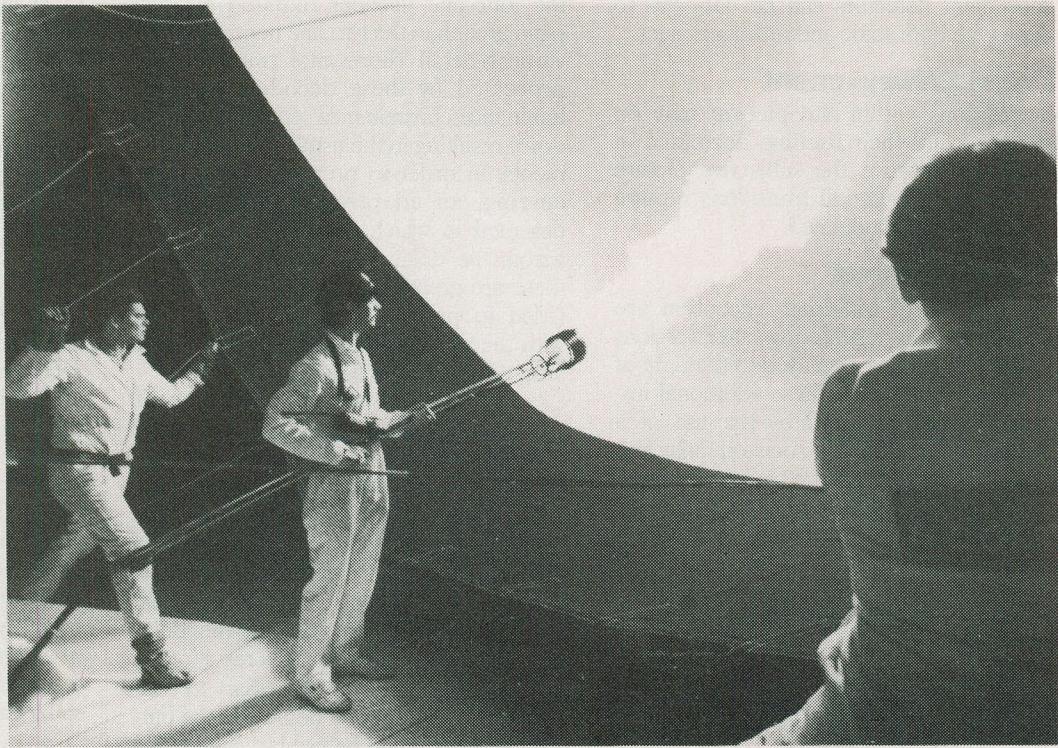
DAVID P. DEMPSTER

Reaching For The Sky

That's what balloonist Per Lindstrand did when he hit an altitude of 65,000 feet (19,812 m) and set the official U.S. national balloon altitude record on June 6 of this year. His predawn flight eclipsed the previous top mark 55,134 feet (16,805 m). Verification of this record was forthcoming from representatives of the National Aeronautic Association (NAA). This NAA verification is also the first step required in a three-step process which will result in Lindstrand claiming the world altitude record for his feat in the skies over Texas.

Initial estimates of 59,700 feet (18,200 m) were upgraded after NAA examination of the measuring instruments and data carried aloft in the balloon's capsule. The data was forwarded to the Royal Aero Club in the United Kingdom which will certify the record set by the British-built balloon. The third step in the verification process will come from the Federation Aeronautique Internationale based in Paris and is expected late this fall.

This latest accomplishment was made possible by the combination of Lindstrand's skills and the use of advanced materials technology. Lindstrand piloted the enormous "Stratoquest" balloon to altitudes of over 10 miles during the four hour flight. This record breaking exercise was sponsored by ICI Films, supplier of the Melinex polyester film used to produce the double-skinned laminate from which the balloon was made. More than 70,000 square feet (6,500 sq. m) of material was used; 35,000 sq. ft. (3,200 sq. m) of nylon fabric over



Stratoquest crew members hand-inflate the envelope of the balloon prior to lift-off.

which 35,000 sq. ft. of metallized polyester film was laminated. The final balloon structure, all 600,000 cubic feet of it, stood as tall as a 12 story building—120 feet—yet weighed only 499 lb. (226 kg).

Even the capsule was unique. Constructed from an aluminum alloy, it had rolled sidewalls and spun domes top and bottom 0.08 in. thick (2 mm). There was a viewing port in the hatch as well as a 1.2 ft. diameter (366 mm) clear dome overhead. The capsule weighed only 182 lb. (82.5 kg) but when loaded with oxygen, fuel tanks, and instrumentation the weight climbed to 1,300 lb. (590 kg). Both the balloon and the tank were constructed by Lindstrand's company, Thunder & Colt Ltd., of Shropshire, England.

Another claim to the project's success was the special burner system—a two stage titanium and stainless steel unit, developed by Lindstrand and his team over the past five years. The burner used conventional propane fuel for the initial stage of its climb into the stratosphere, and then switched over to a specially developed fuel for the second stage of the ascent. At full burn it generated a staggering four megawatts of power—enough to provide heat and light for a town of 8,000 people.

The flight was not without its serious hazards, on the way up to and down from the stratosphere. Above 40,000 temperatures fall to as low as minus 71 C, about the same temperature as the freezing point of carbon dioxide, or dry ice. At maximum altitude, reached at the halfway mark in

his two and a half hour flight, atmospheric pressure is so low that exposure to the thin air around him by for example, a sudden decompression inside the capsule will cause unconsciousness within seconds, death within minutes. The pressurized capsule took him higher than anyone had previously flown in a hot air-balloon. As a backup safety measure, Lindstrand wore an Air Force type partial pressure suit, and an emergency parachute, which he fortunately, did not have to use.

Lindstrand is best known for his record breaking flight across the Atlantic with Richard Branson in 1987. A keen pilot since his teens, he learned to fly a glider while still in school in his native Sweden. He built his first balloon while serving in the Swedish Air Force and later taught himself to fly it. Twelve years ago he became a resident of Great Britain and in 1978 founded Thunder & Colt Ltd. His company has been a leader in developing new technologies and pioneering new skills in hot air balloon design and construction. He built and piloted balloons that were used as launch bases for the world hang-glider and civilian freefall parachute records. Thunder & Colt today has a clientele of more than 500 companies worldwide and builds some 250 balloons each year in four British factories, of which 75 percent were exported last year to 43 countries.

What does this technology hold for the future? According to an ICI spokesman, apart from testing the durability of Melinex over a wide range of industrial and commercial applications, the company sees their metall-

ized film increasing the efficiency of present day sports balloons by making them less porous, and by utilizing the heat from the sun's rays. This in turn leads to greater fuel efficiency and extends the time such balloons are able to stay aloft.

Photonics — The Route To New Communications Technologies

Photonics is the field concerned with gathering, transmitting, and processing speech, data, pictures, and other information by means of light and as such is a relatively new and exciting entry into the world arena of science and technology. Targeted are international markets that could be worth more than \$400 billion each year.

A 12 member panel, chaired by John E. Whinnery, University Professor Emeritus in the department of engineering and computer sciences, University of California at Berkeley, scrutinized new equipment and techniques in which photons—particles of light—replace or work in combination with electrons. The speed of photons and the devices using them is much greater than that of electrons and electronic equipment. Photons move at the speed of light, are resistant to radiation-caused interference, and have other properties that make them superior to electrons. Light signals can also travel longer distances than electrical signals before they diminish to the point that they must be reamplified.

Already, light carrying optical

fibres have almost entirely replaced copper wires and radio waves as the transmission medium for telecommunications exceeding five miles. Moreover, the power of fibre optics has increased dramatically. The capacity to carry information has doubled almost annually. In fact, in the lab, scientists have demonstrated that fibres can transmit several billion bits of information per second over a span of 100 km without reamplification.

Among the lucrative opportunities identified are short-distance applications connecting computers and related equipment in offices, factories, and campuses. Eventually, such local area networks are predicted to evolve into larger networks linking virtually all institutions, businesses, and residences in a metropolitan area. Such networks are referred to as BISDN (broadband integrated service digital networks).

BISDNs are the vision of the future, according to the panel. Fundamental to such a concept is bringing fibre (optics) to businesses and residences because wire cable does not have the required information-carrying capacity. To accommodate this vision of the future, certain improvements in fibre cables, transmitting and receiving equipment, switching tech-

nologies, and the design of communication networks will be required. In the long term, all-photonic computers may be developed, replacing the now ubiquitous semiconductor chip, which operates by regulating the flow of electrons instead of photons. This technology, however, is still in the research stage. Other future uses for photonics include optical storage and retrieval methods for data now stored on magnetic tapes and disks and optical sensors for robots, automated control systems, and advanced imaging equipment.

For those interested in exploring this subject somewhat further the committee's report, "Photonics: Maintaining Competitiveness in the Information Era", is available from the National Academy Press, National Research Council, Room 384, Milton Harris Bldg., 2001 Wisconsin Ave., N.W., Washington, D.C. 20418, \$11.95 (U.S. prepaid).

Designing "Fat" Chips

That's just what a group of scientists have done at the Microelectronics Center of North Carolina (MCNC), Duke University, and North Carolina State University. The researchers have come with a superconductor chip that



has 1.1 million transistors on it. They call the 1 cm² chip the Blitzen and it was produced employing CMOS technology. The director of the team, Tom Krakow, says it is one of the most complex logic chips ever designed. It is capable of dividing computing tasks

into many components so that they can be simultaneously computed. A truly massive parallel processor, its architecture and software aspects were partially funded by NASA. A possible target for the chip—a main element of a space station supercomputer. ■

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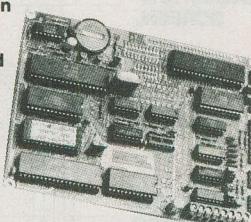
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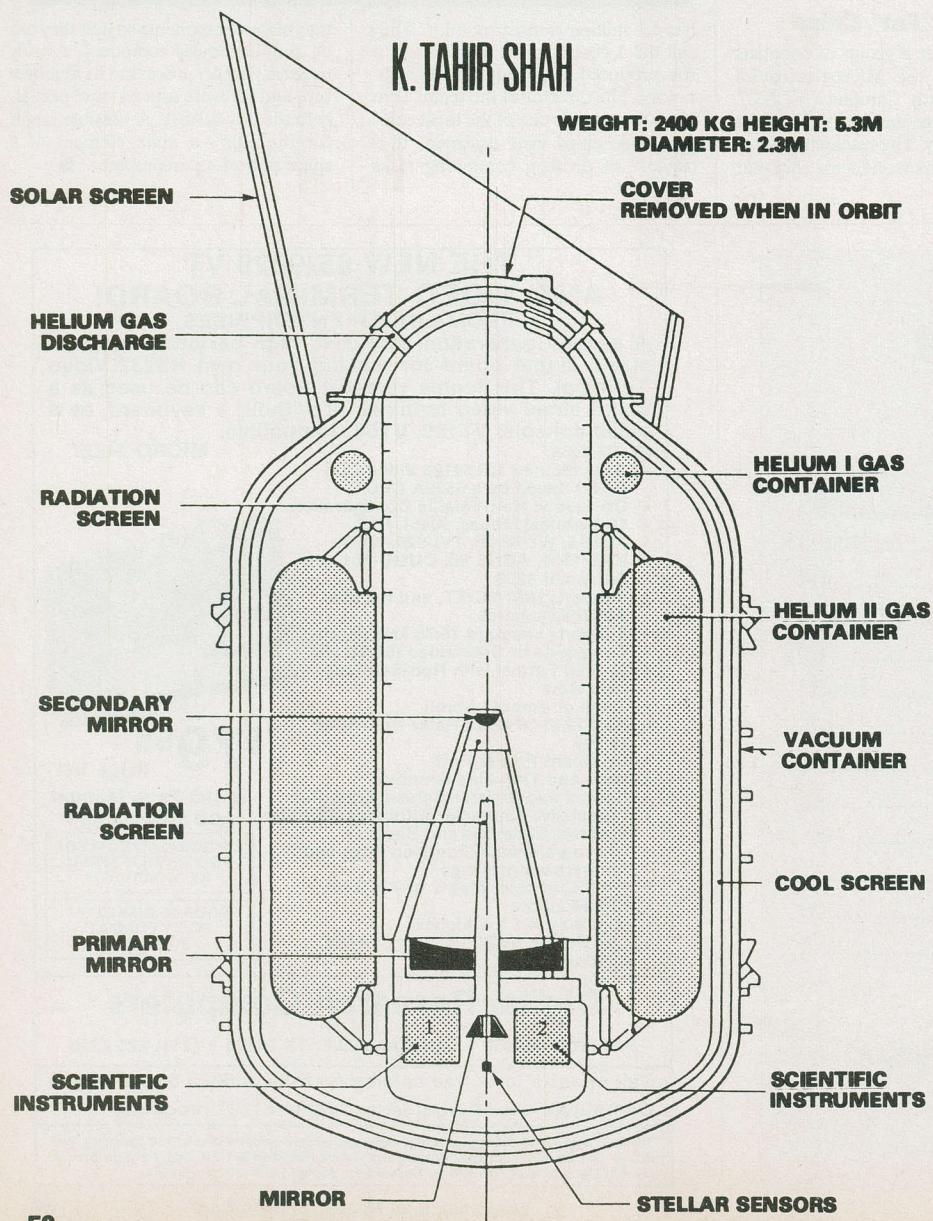
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The European Infrared Space Telescope



One of the most important projects of the European Space Agency is their infrared space observatory to be used for astronomical research in infrared region of electromagnetic spectrum. It is known that stars emit light of different colours and beyond the visible light they also emit ultraviolet rays, x-ray as well as low frequency "colours" beyond red (called infrared). The analysis of visible light, infrared emission, x-rays, radio waves and so on gives us knowledge about the structure of the star and the processes which are going on deep inside their core.

Participating nations include France, Italy, the U.K., Holland, Spain, West Germany, Austria, Switzerland, Sweden and Ireland. The prime contractor is Aerospatiale from France which will be concerned in particular with the optical subsystem and sun shield elements of the project. There is a long list of universities and other research institutes which are involved in the development of the space telescope and observatory. On this side of the Atlantic, a non-European agency, the U.S. Naval Research is also a participant.

Sometime in the first few months of 1993, the European Satellite ISO, namely the Infrared Space Observatory will be launched. It will be devoted to astronomical observations in the wavelength 3 to 200 micrometers. Since the colour of light is directly related to its wavelength, the observatory will be used to conduct experiments and gather data in these wavelength intervals. One micrometers is one millionth of a meter. These wavelengths are not visible to our eyes. Our eyes are sensitive to the shorter wavelengths (from red to violet only) of the electromagnetic spectrum. Infrared astronomy is very similar to ordinary astronomy in the visible light spectrum which has been known to us for centuries. Since we cannot see the infrared light, special sensors are used which are sensitive to wavelengths in this infrared region. It is also possible to photograph objects which emit infrared light using special photographic instruments. The infrared observation of celestial bodies gives us information which may not be available in the visible or ultraviolet part of the emission or absorption spectra.

The observatory will contain a telescope of 60cm in diameter, supercooled by liquid helium to a temperature of about 270C below zero, which is about 3C above the absolute zero. There will be four sets of instruments mounted on the focal plane of the telescope. Each of these instruments are

being built by a consortium of research institutes of the European Space Agency member countries. These instruments are to be used in spectroscopic and photopolarimetric measurements in space.

From the technical point of view ISO will be a unique observational system in its category. There is already some ground work done in infrared astronomy using IRAS, the Infra Red Astronomical Satellite. Using IRAS for over ten months, European scientists obtained a sky map for 8 to 120 micrometer wavelength infrared light. The Phase B, the detailed definition of the project, was included in January 1988 along with actual construction of the whole system. The launch will take place using Ariane IV booster at the French Guyana facility in West Africa.

The Satellite

Figure 1 shows exactly the way the satellite is supposed to be in orbit. It will measure 5.3 meters high and have a diameter of 2.3 meters. The total weight at launch will be 2400kg. The satellite is made of cryostat, thus acting as a thermally insulated container which will protect the telescope and other experimentation instruments from solar heat. The solar screen is a double purpose device. Firstly, it is to protect the telescope from the heat produced by the sun's rays. Secondly, with solar cells at its surface it will produce electricity for the observatory's operation. Underneath the cryostat on a platform there will be the service module containing telemetry and control instruments for the satellite as well as for experiments. The tele-command transmission bit rate will be 2kb/s and 43.7kb/s for telemetry (of which 33kb/s will be allotted to scientific instruments).

Cooling System

The cooling for optics and the research experimental equipment is achieved through the use of 2300 litres of superfluid Helium. Using this cooling system, it will be possible for more than 18 months to maintain 10 Kelvin degrees for the optical systems of ISO, 3 Kelvin degrees for the focal plane and 1.6 Kelvin degrees for the detectors. There will be another 60 litre reservoir of liquid Helium to be used for other purposes.

It is necessary to have such extremely low

temperature for infrared astronomy because infrared waves are essentially heat waves and they are of very low intensity, particularly if they are coming from a distant object, such as a star in our galaxy. To detect infrared radiation of such low intensity, it is important that the background temperature be very low so that signal to noise ratio is fairly good. A question one might ask is why is a space observatory necessary? The answer lies in the fact that all kinds of optical observations from the ground create some experimental problems such as wobbling (twinkling) of stars. This twinkling is due to the presence of atmosphere. This continuous change of density, temperature and other factors in the atmosphere cause light rays to move according to the values of these physical parameters.

Orbit And Its Effect On The Sensitivity Of ISO

Initially, it was thought to launch ISO with Ariane II rockets into an orbit with apogee (farthest distance from the Earth in an elliptical orbit) of 3900 kilometers and perigee (nearest distance from the Earth) of 1000km. However, during 1987, it was decided to use a more powerful booster, namely Ariane IV, and to put ISO in an orbit with an apogee of 70,000km and perigee of 1,000km. The advantage of this new orbital height is to keep the satellite away from the radiation belt, thus reducing the bombardment of high energy particles on detectors and other instruments. In the old orbit, because of radiation bombardment, there was a need for high speed preamplifiers to distinguish photons from particles. In the new orbit the low speed preamplifiers will get the job done. Since these preamplifiers were never used in an orbital environment, it has caused some headaches for the scientists involved in the ISO project. Due to the higher cost of the new orbit the European Space Agency has decided to use only one receiving station (on the ground) so as to maintain strict budgetary control. In any case, hopefully we will see ISO in its operational state in 1993. ■

Horizon 2000 European Space Agency's Blue Mission

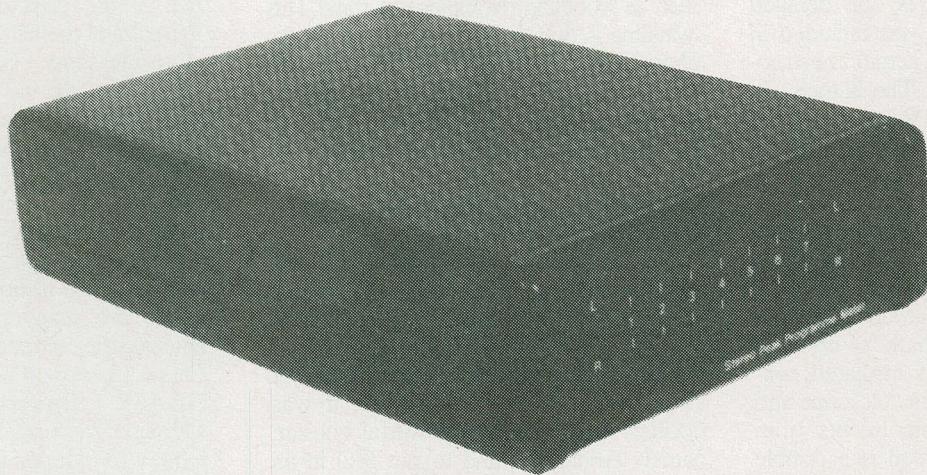
In a letter of June 15, 1988, from the office of the director of the Scientific Program of the European Space Agency to the space science community of its member countries, an announcement was made for the selection of what has been called the first "blue" mission in the framework of Horizon 2000. The name Horizon 2000 is refers to the long-term plan for space science in Europe. The so called blue mission is the flexible part of the plan. There are many projects which are entering the competition. These are: Cassini (Saturn orbiter and Titan probe) GRASP (Gamma-Ray Astronomy with Spectroscopy and Positioning) Lyman (High resolution spectrography in the 900-1200 Å band) Quasat (A space VLBI satellite) Vesta (Mission to small bodies of the solar system: asteroids and comets)

The Phase A studies on these projects are now in their final stage. Project selection by the ESA's Science Program Committee is based on recommendations of advisory bodies such as the Astronomy Working Group, Solar System Working Group and the Space science Advisory Committee. Selected projects will enter their detailed design and development phase in early 1990.

Peak Program Meter

Long a European standard, the PPM offers advantages over the VU

IAN COUGHLAN



There are two major differences between the typical peak program meter and the VU meters that are more familiar to most people. The PPM has very different ballistics—it attacks quickly and decays slowly so that peak signal levels are clearly displayed. In addition the PPM's scale is roughly linear, whereas the scale of a VU is anything but.

A Different VU

Let's look at the VU meter in more detail. The audio signal is rectified and integrated to produce a reading corresponding to the average signal level (the PPM shows the peak level). At the left end of the scale is -20, and at the right end is +3VU. About two-thirds of the way along is 0VU, which by convention corresponds to +4dBm in professional equipment (0dBm in domestic units).

Put a sine wave into the VU meter at a level of +4dBm and it will read 0VU. Simple. Put a typical audio signal in at an average level of +4dBm and it will still read 0VU, although the needle will jump around a bit in response to the signal.

A typical audio signal however, contains peaks that will be more than +4dBm. Since a VU meter integrates, these peaks will not produce a proportionate increase in

the meter reading and the audio system can be driven into overload even though the meter says everything is fine.

This may be relatively unimportant—analog tape recorders, for example, exhibit a soft overload characteristic and the distortion is not too objectionable. Other media are not always so forgiving. Digital recording systems, radio transmitters and audio amplifiers have very sharply defined upper limits. Drive them even a little above their limits and they simply will not go. The signal will clip and the resulting distortion is very nasty indeed.

Obviously the best signal-to-noise ratio from an audio path is obtained by running as close to the upper limit as you can, short of overload. If all you've got is a VU meter, the peaks are not going to register, so you'll have to allow a considerable amount of headroom above the average signal level for these peaks and that's going to compromise the performance at the bottom end.

Enter the PPM

The fast response of the PPM means that the magnitude of peaks within the signal can be monitored with precision and if you know where your system's upper limit is (it's easy to find, just increase the signal until the output clips), adjust the level so

that the peaks are just below the limit. You may want to allow headroom for extra large peaks, but with prerecorded or broadcast material the recording engineers will have squashed those out long before they get to you.

Not just any old meter can be used for a PPM. Only specialized (and expensive) movements have the necessary ballistics, most ordinary movements being far too slow. The PPM to be described in this article uses LEDs in place of a meter movement and they're as fast as anyone could want. Cheap, too—the cost of producing this stereo PPM with built-in power supply is less than the price of one PPM meter with drive card. True, it doesn't have the ultimate accuracy of such a meter, but in side by side comparisons monitoring typical program material, no visual differences could be observed.

The PPM scale is quite distinctive. Unlike the VU meter which tends to squeeze the area of interest into the top half of the scale, the PPM stretches this area out so that it spans the full width of the scale.

The PPM1 on the left corresponds to -12dBm, PPM7 on the right is +12dBm. In the center of the scale is PPM4, which is 0dBm. The scale markings are equally spaced, each 4dBm from its neighbours.

PPM	Volts RMS	Volts Peak	dBm
1	0.195	0.275	-12
2	0.308	0.436	-8
3	0.489	0.69	-4
4	0.775	1.095	0
5	1.228	1.736	+4
6	1.946	2.752	+8
7	3.084	4.36	+12

Note:

0dBm is referred to 1mW in 600R, accepted as 0.775V RMS.

Table 1 PPM display levels.

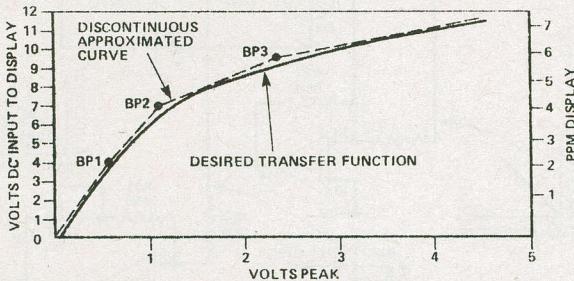


Fig.1 Transfer functions for the peak program meter.

Table 1 shows the PPM numbers with their corresponding dBm levels and voltage levels (RMS and peak). To achieve this linear scale a nonlinear amplifier is needed. Fig.1 shows the desired transfer function of this amplifier. The function is realized in this design by a technique known as discontinuous approximation. The output of the nonlinear amplifier does not change in a smooth, continuous manner; instead the transfer function consists of a series of straight lines, designed to approximate to the desired curve as shown by the dotted curve. The slope of the amplifier is made to change at each breakpoint and the more breakpoints and slopes there are the more accurate will be the approximation.

This design uses three breakpoints and four slopes, which is quite adequate for the application. Fig.2 illustrates the technique.

For all the input voltages up to +1V, the gain of the amplifier will be -1 since Q1 will be nonconducting (its base is held at -0.3V). As the output falls below -1V, Q1 will begin to conduct, providing an extra feedback path around the amplifier. The feedback resistance is now effectively R3 in parallel with R2, so that the gain becomes -0.5. Further breakpoints can be added as shown.

How It Works

The circuit diagrams of the two boards are shown in Figs. 3 and 4. Apart from the power supply, the PPM consists of identical circuits, so for reasons of clarity only one half will be described.

IC1a is an inverting amplifier with a gain of about 20dB when SW1 is in the -20dBm position and unity gain when in the 0dBm position. In this way the PPM can be used on professional equipment with signal levels of 0dBm and also on domestic equipment which has a much lower signal level. Note that the input impedance will be 9.1k in the -20dBm position and 100k in the 0dBm position.

IC2a and b are configured as a full wave rectifier. IC2a will ignore the positive half cycle of the signal waveform, but will invert the negative half cycle. IC2b will do the reverse. The resulting signal on D2's cathode will be positive going and is used to charge C3 via R8. The voltage on this capacitor is equal to the peak input signal level. The charging time constant is determined by R8 and C3, the discharge time constant is determined by R4 in series with R8 and C3. This is what gives the PPM its fast attack/slow decay characteristic. IC2c buffers the voltage on C3. IC2d is the nonlinear amplifier and its operation is described elsewhere in the article. RV3

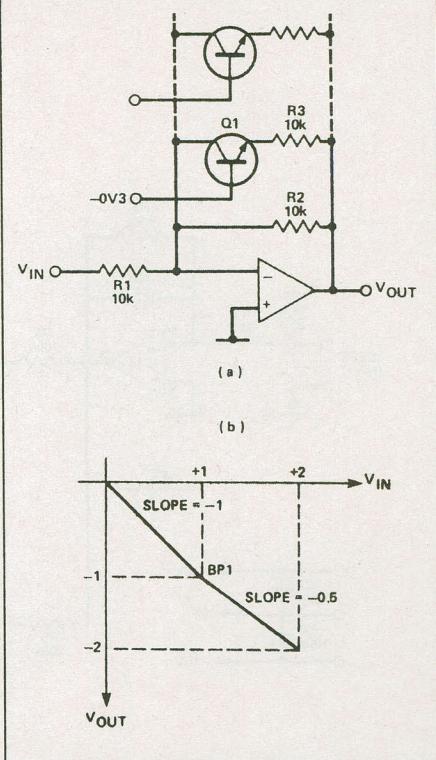


Fig.2 Setting transfer function breakpoints.

sets breakpoint 1 (BP1), RV2 sets BP2 and RV1 sets BP3. Before BP1 is reached, the gain of the stage is R13/R9. Above BP1, R12 is in parallel with R13 and the gain falls accordingly. Above BP2 but below BP3, R11, R12 and R13 are all in parallel. Above BP3, R10, R11, R12 and R13 are in parallel. Thus as the input rises, the gain of the stage drops to a lower value at each breakpoint.

Construction

The front and rear panels should be cut and drilled as shown in Fig.5. Drilling the holes in the front panel will not be as easy as it looks. The trick is to drill the four large holes first and fix stripboard to the panel with the holes aligned with the positions of the LED holes. Now drill pilot holes in the panel, 1mm in diameter, using the strip as a jig. Remove the stripboard and drill the holes out to 2mm. But be warned – don't rush ahead. Practise on a piece of scrap material first.

Fix the phono sockets, slide switch, and power inlet to the rear panel. Also, fit a solder tag to the rear panel for the ground connection: mains voltages are present within the unit and it's up to you to see that it is safe to use.

Solder R55 and R56 to the slide switch, SW1. Put all the LEDs into a piece of stripboard (observing polarity) but

Peak Program Meter

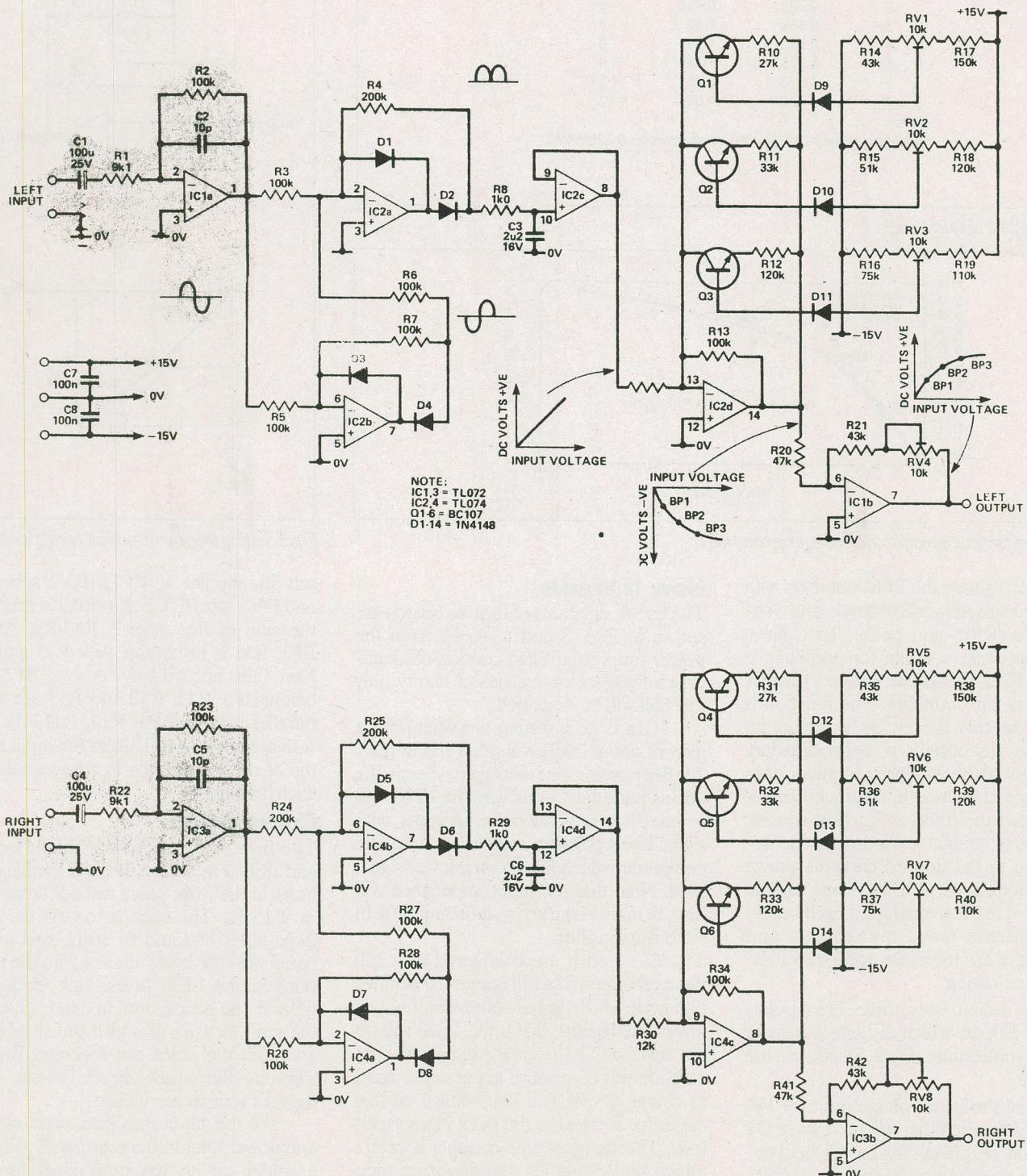


Fig.3 Circuit diagram of the small board.

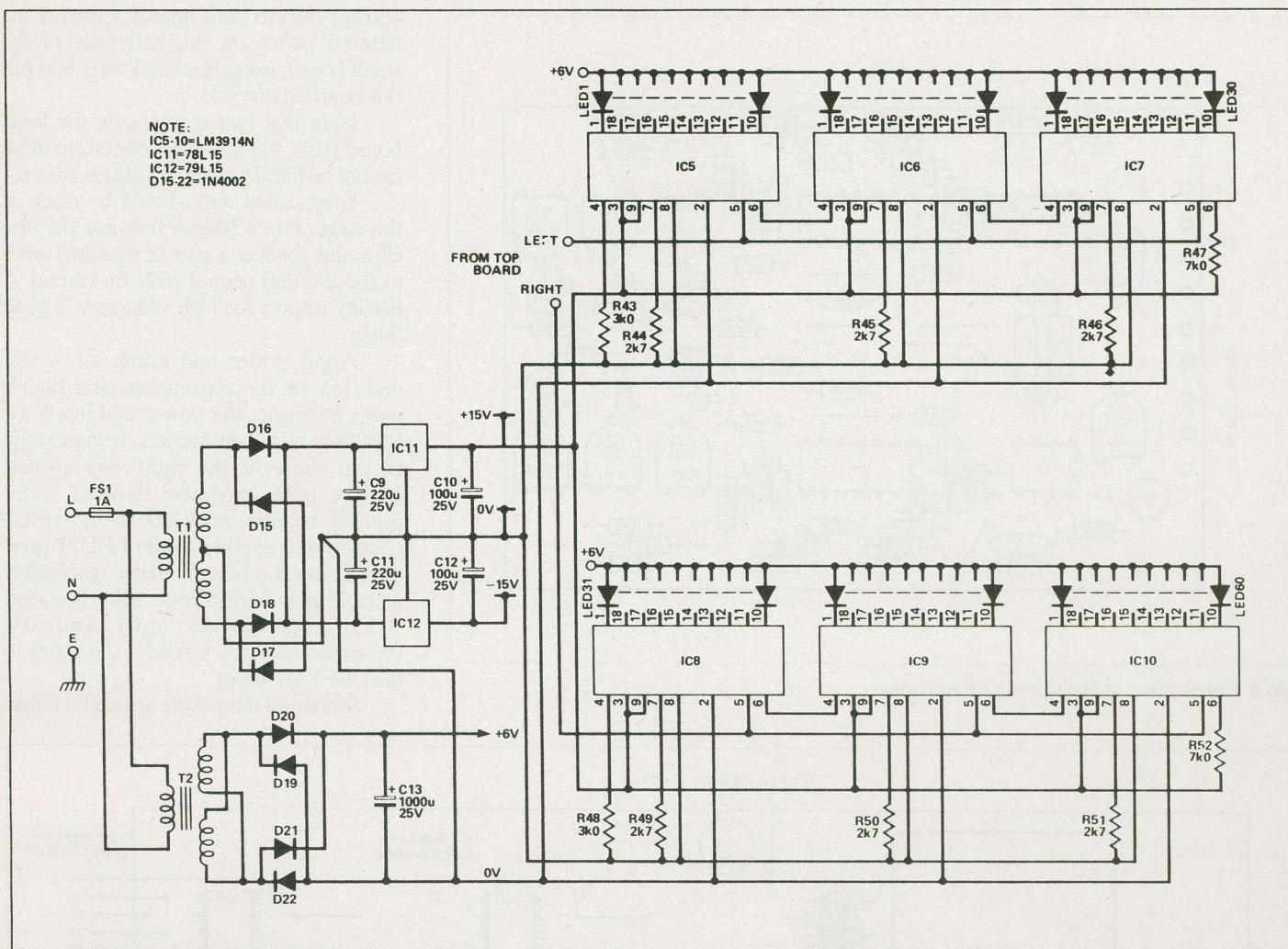


Fig.4 Circuit diagram of main board.

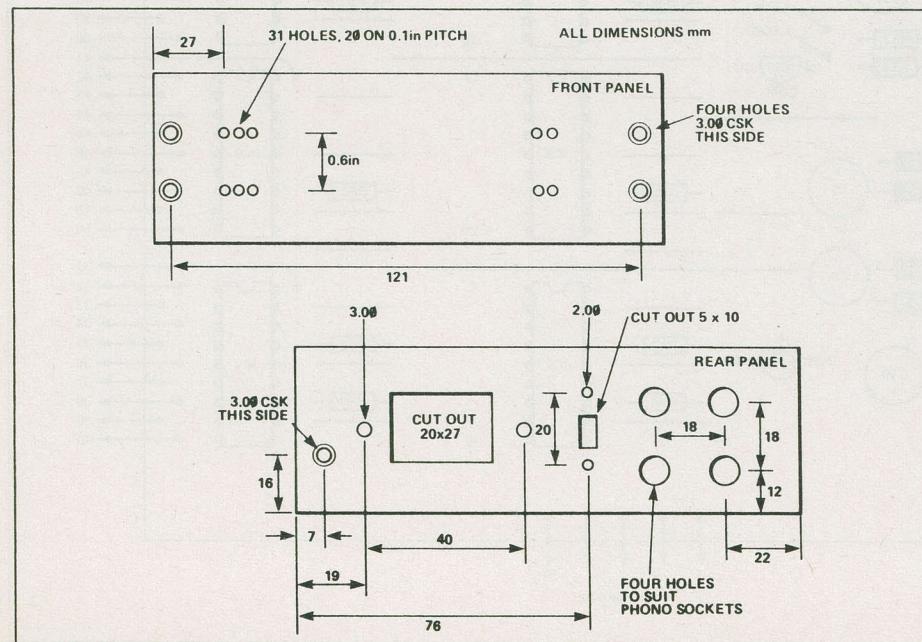


Fig.5 Front and rear panel drilling.

don't solder them yet. Guide the LEDs through the holes in the front panel, and fix the stripboard to the panel using countersunk screws from the front and 6.35mm (1/4 in) spacers. Fix a solder tag to one of the screws—this is the ground connection for the front panel.

Now is a good time to check that all LEDs work using a power supply of about 12V and a series resistor of 4k7. If all is well, slide a piece of thin card down between the two rows of LEDs, to prevent light from one row spilling into the next. Put the front and rear panels to one side.

Check both PCBs for short circuits before you start on them. The overlays are shown in Figs.6 and 7. Insert the through pins from the copper side of the large board and from the component side of the small board. This will keep all the wiring between the boards, resulting in a neater overall appearance.

Fit and solder links, resistors, capacitors, DIP sockets, trim pots, fuse clips, transformers and semiconductors

Peak Program Meter

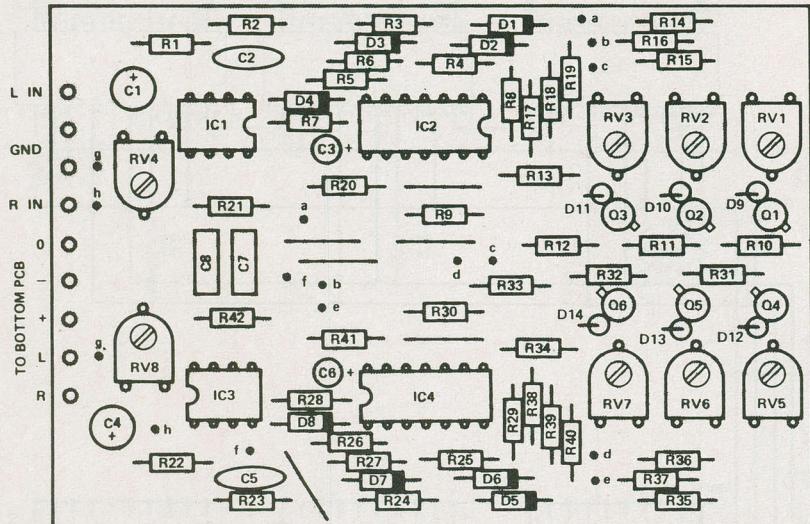


Fig.6 Component overlay for the small board.

(except ICs) to both boards. Connect the lettered points on the underside of the small board, using insulated wire, and put this board to one side.

Note that two resistors on the large board (R47, 52) are select on test, so these cannot be fitted until their value is known.

Some initial tests should be made at this stage. Pop a 500mA fuse into the fuse clips and connect a pair of insulated wires to the live and neutral pins. Be careful. A healthy respect for high voltages is a good thing.

Apply power and check for +15V and -15V on the appropriate pins. If all is well, disconnect the power and insert the LM3914s into their sockets, being careful to put them in the right way around (they're quite expensive devices). Temporarily connect an LED to the LED23 position and another to the LED27 position. Connect a potentiometer (preferably a multiturn trim about 10k) between +15V (clockwise end) and 0V (counterclockwise). Connect the wiper to the LEFT input pin.

Switch on the power again and adjust

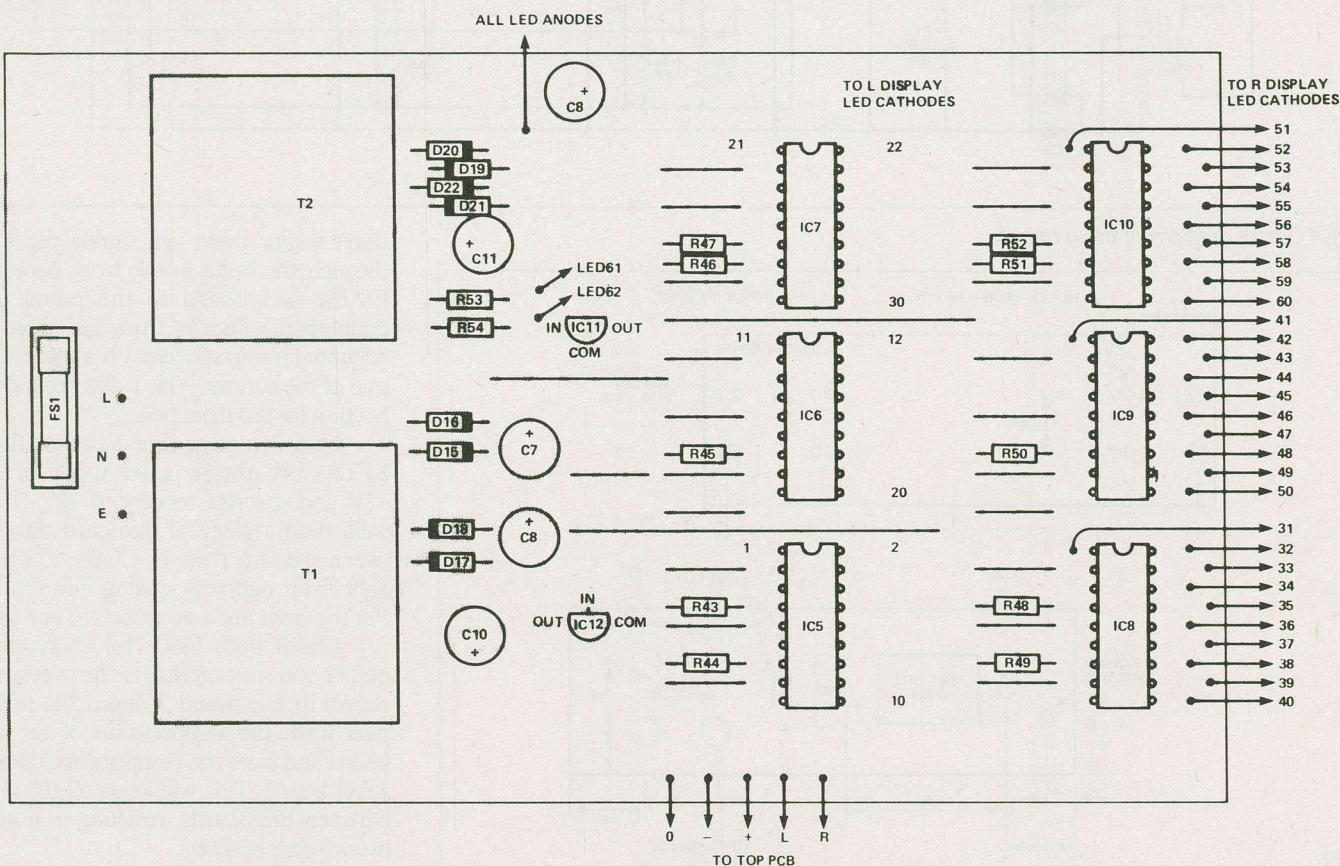


Fig.7 Component overlay for the main board.

the potentiometer for +11.25V on its wiper. R47 must now be selected so that LED27 is only just on. Another preset (20k) will make this easier. When the value is known, solder R47 into place. It may be necessary to fit two or more resistors in series or parallel. Now check that LED3 is on above a voltage of +1.25V on the wiper of the multturn preset.

The above procedure must now be repeated for the RIGHT channel, so move the LEDs over to LED33 and LED57 and move the wiper of the multturn preset to another input. Once you're happy with both channels, disconnect the power and remove all the other temporary connections.

Wire in the cathodes of the LEDs. The left hand LED of each channel (LED 61, 62) are lit at power-on and connect to the center of the main board. The display for the left channel then runs from LED30 to LED1 and for the right channel from LED60 to LED31. Fix the two boards together with 1in spacers. Fit the ICs to the small board. Cut a piece of card and fit it to isolate the input sockets from the mains end of the PCB. Drop the two PCBs into the box and fix the assembly into place. Fit the front and rear panels and wire them to the large PCB as shown

in Fig.8. Remember to fit an insulating boot to the power connector and to connect the ground wires.

Calibration

Calibrating the PMM is very straightforward. You'll need an audio oscillator, capable of producing to +12dBm (3.08V RMS). The procedure is identical for both channels, so do the left channel as described here and then the right channel, with appropriate changes to component references.

Set the slide switch on the rear panel to the 0dBm position. Apply a sine wave at a level of -8dBm (304.4mV RMS) to the left input, and adjust RV4 until the meter reads PPM2. Increase the signal level to 0dBm (775mV RMS) and adjust RV3 for PPM4. Increase the signal level to +4dBm (1.228V RMS) and adjust RV2 for PPM5. Increase the signal level again to +12dBm (3.08V RMS) and adjust RV1 for PPM7. Check the PPM points against the signal levels shown in Table 1 and if necessary repeat the above procedure. When you're happy with the left channel, move onto the right.

Calibration is now complete. Fix the lid in place and the PMM is ready for use. In use, the PMM simply connects into the audio circuit you want to monitor. ■

PARTS LIST

Resistors

(all 1/4w 5% unless specified)

R1,22	9k1
R2,5,6,7,13,23,26,27,28,34	100k
R3,4,24,25	200k
R28,29	1k0
R9,30	12k
R10,31	27k
R11,32	33k
R12,18,33,39	120k
R14,21,35,42	43k
R15,51	51k
R16,37	75k
R17,38	150k
R19,40	110k
R20,41	47k
R43,48	3k0 2%
R44,45,46,49	91k
R50,51	2k7
R47,52	7k0 (Nominal: see text)
R53,54	3k9
55,56	91k
RV1-8	10k trim pot

Capacitors

C1,4,10

C12,13..	100u 25V electrolytic radial
C2,5.....	10 polystyrene
C3,6.....	2.2u 16V tantalum bead
C7,.....	100n ceramic
C9,11.	220u 25V electrolytic radial
C10....	100u 25V electrolytic radial

Semiconductors

IC1,3	TLO72
IC2,4	TLO74
IC5-10.....	LM3914N
IC11	78L15
IC12	79L15
Q1-6.....	2N3904
D1-14.....	1N4148
D15-2	1N4002 or equiv.
LED1-62	red LED

Miscellaneous

FS1.....	1A fuse
SK1-4.....	Phono sockets
SW1 ..	DPDT submin. slide switch
T1.....	30V center tap
T2	12V center tap

Case, fuse clips, IC sockets, solder tags, stripboard, cardboard, pins, insulating sleeving, wire, nuts and bolts. If PCB transformers are not available, standard transformers may be used, mounted on or off the PCB with nuts and bolts.

Fig.8 Constructional diagram.

Model Railway Circuits

ROBERT PENFOLD

This is a pulse type train controller that is primarily intended for computer control. Although the range of available speeds is rather limited (stop, full speed, and two intermediate) the transition from one speed to another has been made very gradual to avoid any unrealistic jumps in speed. The circuit can easily be modified to provide a greater range of speeds if desired.

The unit provides a variable average output voltage by varying the mark space ratio of the output signal. Provided a suitable output frequency is used, this type of signal is suitable for driving DC electric motors. In fact, it gives very good results; fine speed regulation and immunity from stalling at low speeds. This circuit uses a standard pulse width modulator with IC1 to provide the triangular clock signal, and IC2 operating as the voltage comparator. The clock frequency is just over 200Hz, which seems to give good results with any small DC electric motor.

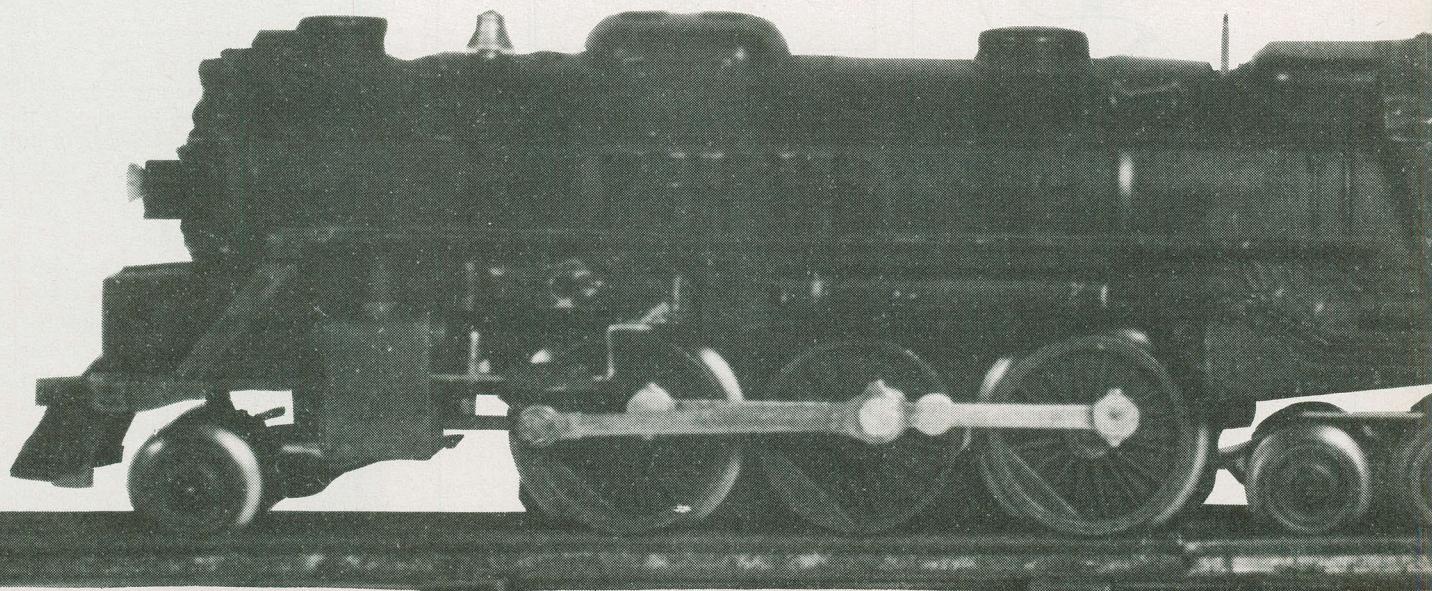
With the voltage at the noninverting

input (pin 2) of IC2 halfway between the peak to peak voltages of the clock signal, the output signal is a square wave having perfect 1:1 mark space ratio. Taking this input voltage higher results in it being exceeded by the clock signal for a smaller percentage of the time, and the high output period becomes longer than the low output time. Reducing the input potential has the same effect. This gives the desired result, with an average output voltage that is proportional to the control voltage.

Q1 and Q2 form a complementary emitter follower output stage that enables the unit to handle output currents of up to a couple of amps. Q2 is not strictly necessary but with D1 it helps to suppress voltages generated by the motor when Q1 is switched off. As Q1 operates in a switching mode it only requires a small bolt on heatsink. Q2 does not require a heatsink at all. For a straightforward manual control, a potentiometer circuit to drive pin 3 of IC2 is all that is required. For computer or digital control a DAC is needed, and a very simple and inexpensive 2-bit circuit can be used.

The state of the signal inputs 1 and 2 alter the resistive network determining the signal fed into IC2, and therefore the speed of the train. With both inputs at 0, Q3 and Q4 are off so that R8 and R9 provide a high enough control voltage to keep the controller output continuously high. Applying a logic 1 signal to input 1 or input 2 shunts either R10 or R13 across R9, giving a lower voltage and a lower average output voltage. As R10 and R13 have different values, the two logic inputs provide different speeds. Taking both inputs to logic 1 produces a very low average output voltage, and the train halts.

More transistor drivers and shunt resistors can be added to give greater range of speeds. The transition time between speeds is proportional to the value of C4 and is easily changed. A reasonably smooth and stable 15V supply, with current limiting to protect the unit against the inevitable short circuits on the output, is provided by a simple smoothing and regulator circuit fed from the raw 12V DC output of a train controller. Direction con-



trol can be provided manually via a DPDT switch, or under computer control via a relay and driver circuit.

Two Colour Signal

This two colour red/green signal is automatically operated by the train via sensors on the track. There are several ways of sensing the train as it passes but the two most simple and reliable methods are to use micro or reed switches. I prefer reed switches positioned just under the track, activated by a magnet mounted just above track level on one of the pieces of rolling stock. Sometimes the DC motors used in locomotives will activate the reed switches but in most cases a small bar magnet must be added to each train by the constructor. Note that the reed switches are activated when parallel to a bar magnet and not when one pole of the magnet is applied to them. Switches should be mounted lengthwise along the center of the track, with the magnet mounted lengthwise along the middle of the floor of a piece of rolling stock. The distance between them probably needs to be about 10 millimeters or less – this should be possible without continual derailment. The purpose of the sensors is to set the signal to the red as it is passed by a train and then to reset it to green when the train has progressed to some point further along the track. The circuit is basically just a S-R flip flop built around IC1b and IC1c. The other two gates of IC1 are wired up as inverters and used as buffers at the outputs of the flip flop.

SW1 is the reed switch near the signal and when this is activated it sends the output of IC1a high. This switches on Q1 and

the red signal LED1. SW2 is further along the track, and returns the output of IC1a to the low state. It also sends IC1d high activating LED2, the green signal.

Problems with spurious triggering due to switch bounce or stray electrical noise in connecting cables are counteracted by R4, C2 and R6, C3. If manual override is required, add push button switches in parallel with SW1 and SW2. It should be possible to control a ready-made signal, but LED types will probably incorporate current limiting resistors and R1 and R8 will then be unnecessary. The unit should also be able to control sub-miniature 12V filament bulbs in the same way, but the bulb current should not exceed about 200mA.

A 9 or 12V battery is the easiest source of supply. IC2 and C4 to C6 are only needed if the unit is fed with the raw 12V DC output of a train controller.

Two Tone Horn

This sound effects unit is designed to simulate the sound of a two tone horn, as used on many diesel and electric locomotives. This is the type of horn that goes up about a fifth in pitch (about 50% higher in frequency) after the initial tone. The basic sound is not just a simple tone, and is actually a quite complex signal.

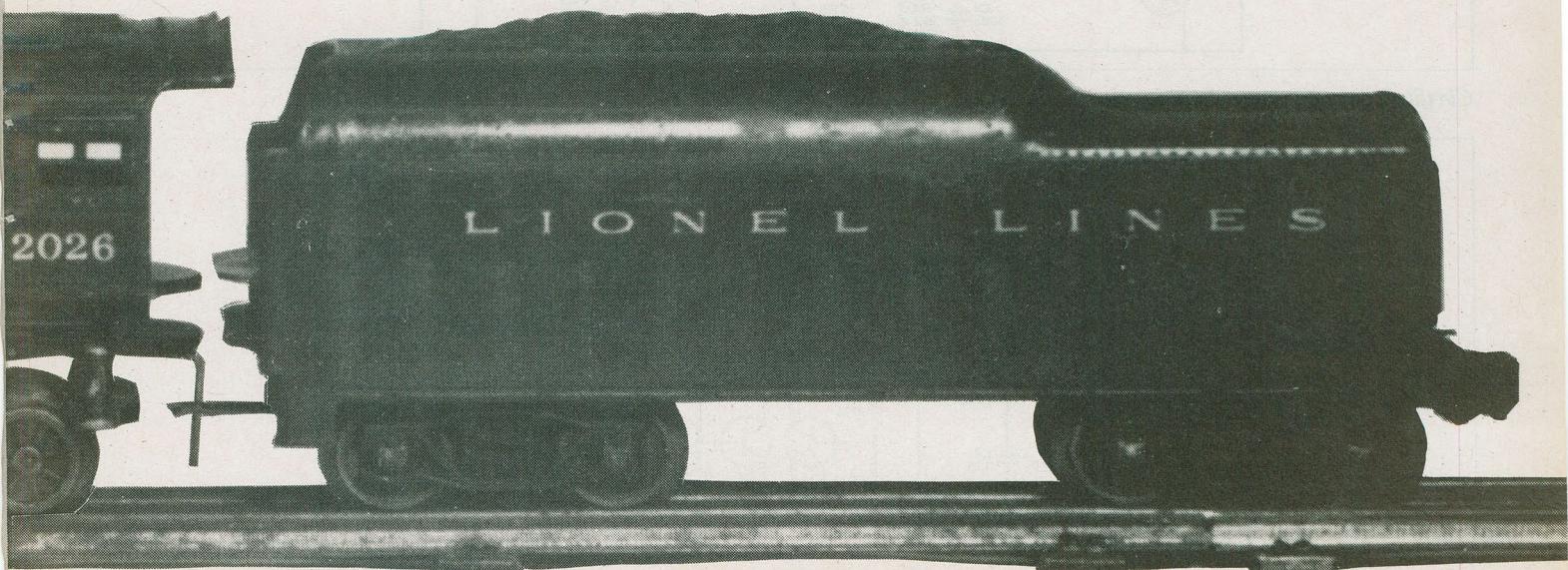
Accurately simulating an intricate sound of this type is far from easy but results here are about as good as you are likely to obtain from a simple circuit and a loudspeaker of about 65mm in diameter. Unless you are a steam only fanatic, it should certainly add a bit more realism to your railway layout.

The basic audio signal is generated by

a 555 timer (IC1) used in the standard astable circuit. It drives a miniature high impedance loudspeaker via common emitter amplifier Q2. LS1 must have an impedance of 64R to 80R and must not be a low impedance type. The oscillator's operating frequency works out at approximately 550Hz but we are using frequency modulation applied via pin 5 of the device and it does not always operate at this frequency.

The horn starts fractionally flat, and moves up to the normal operating pitch over a period of around 200ms, regulated by C1 changing up through R1. Pin 5 of IC1 must be pulled lower in voltage in order to raise the output frequency and give the two-tone effect. This is provided automatically just under a second after switch-on by IC3, a quad 2 input NOR gate which has three of its gates connected to operate as a monostable with an output pulse duration of around 800ms. This is triggered by a switch-on by C7 and R8 but, as it provides a negative output pulse, Q2 is initially switched off. It is turned on when the output pulse ends and it then pulls pin 5 of IC1 lower in voltage by an amount that is controlled using RV2. In practice RV2 is adjusted by ear to give the correct second tone from the unit. C5 gives a smoother transition to the higher pitch for a slightly improved effect.

The second 555 oscillator is used to enrich the sound and its output is mixed with the main tone signal at a much lower level, frequency modulated in exactly the same way as the main tone generator. It is probably best to initially leave one terminal of R9 unconnected so that RV2 can



Model Railway Circuits

be adjusted with only the main oscillator driving the loudspeaker. With R9 connected, RV1 can be adjusted for the best effect. This will probably be with the second oscillator just slightly off-tune from the main one, or perhaps with the second oscillator set about a fifth higher.

Three Colour Signal

This signal is similar to the two colour type but controls a three colour (green, amber and red) signal and requires an additional track sensor. The signal changes from green to red as the train passes the sensor next to the signal. The sensor further along

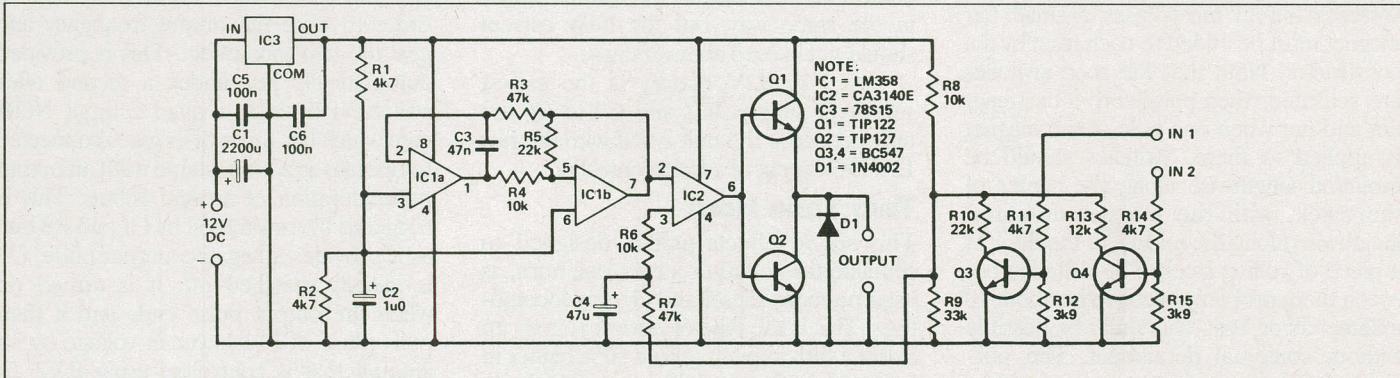
the track sets the signal to amber, and a third sensor still further along the track brings it back to green again. Like the two colour signal, the sensors can be micro or reed switches. The circuit is based on a CMOS 4017BE. This can provide a standard divide by ten action, but it has ten more outputs (0 to 9), each of which go to logic 1 for one clock cycle, in sequence.

C3 provides a reset pulse at switch-on, taking output 0 high driving Q1 into conduction and turning on the green signal LED1. The track sensors (SW1 to SW3) provide a positive pulse to the clock of IC1 each time the train is detected. R1

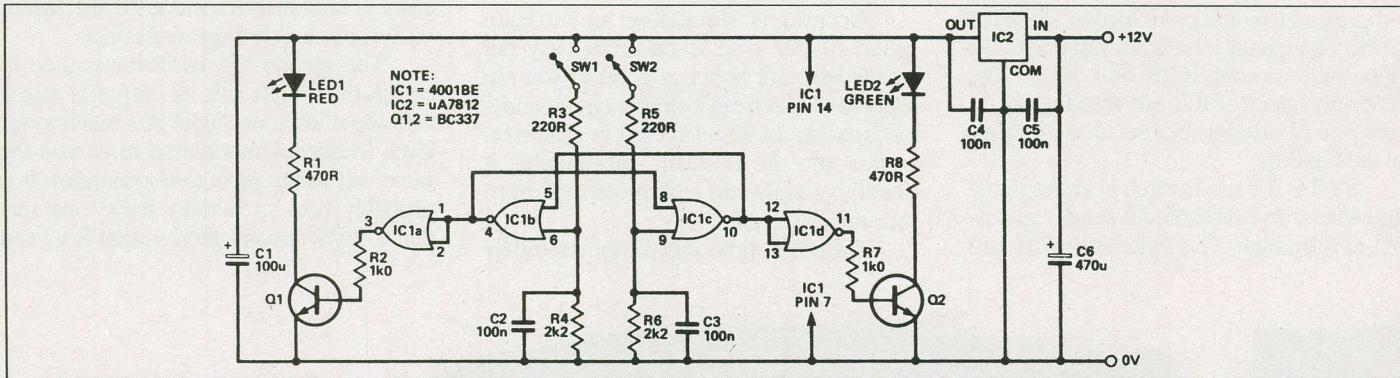
and C2 provide switch debouncing and help avoid problems with electrical noise.

Note that with this circuit it does not matter which track switch is used in which position on the line — the circuit merely requires a clock pulse each time. A switch to permit manual setting of the signal might be useful since, if the train does not pass the signal's switch first, the lights will be out of sequence. A push button switch in parallel with SW1, 2 and 3 can be used to sequence the circuit through to the desired colour.

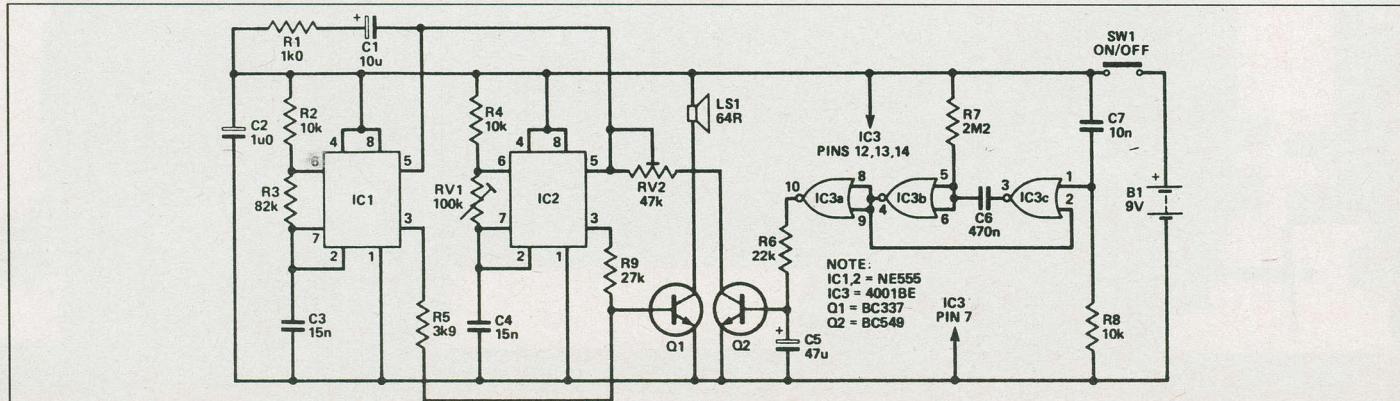
The final clock pulse of each sequence takes output 3 high but this is



Circuit diagram of the digital train controller.



Circuit diagram for two colour signal.



Circuit diagram for two tone horn.



trust me

“Maybe you’re right. Maybe none of us should bother with a car after all.”

“Good. Now tell me, what time do you expect to be home?”

“Aw, Mom.”

“Famous last words.”

“Come on, Mom, you know I’m a good driver.”

“I know. But it’s a big occasion and you’ll be out with your friends. If you wind up having a few drinks you mightn’t be so terrific driving home.”

“I won’t drink. I promise.”

“That’s easy enough to say now.”

“Well, I can always get a lift back with one of the others.”

“I have a better idea. Why don’t you all share a cab instead? It won’t be that expensive and you might be doing yourselves a favor.”

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Model Railway Circuits

coupled to the reset input of IC1 by way of D1 and it takes the circuit back to the beginning of the sequence. If the signal is a home made type, a yellow LED will suffice for LED3 or an orange type might be considered better (orange LEDs certainly seem to be generally much brighter than the yellow variety). The circuit can be powered from a 9 or 12V battery or from the 12V DC output of a train controller using the smoothing regulator circuit from the two-colour signal circuit.

Switch Controller

Some model railway switches are purely mechanical but electrical switches are now a standard accessory. These are mostly very basic and are really just a manual switch with the addition of a couple of solenoid mechanisms giving the option of manual operation or electric remote control using a form of changeover switch plus a 12V DC supply.

The switches have three terminals, one of which is a common terminal wired to one supply rail. The other terminals are wired to the other supply rail via the changeover switch which selects the desired solenoid. By alternating this switch the switches can be repeatedly set and reset.

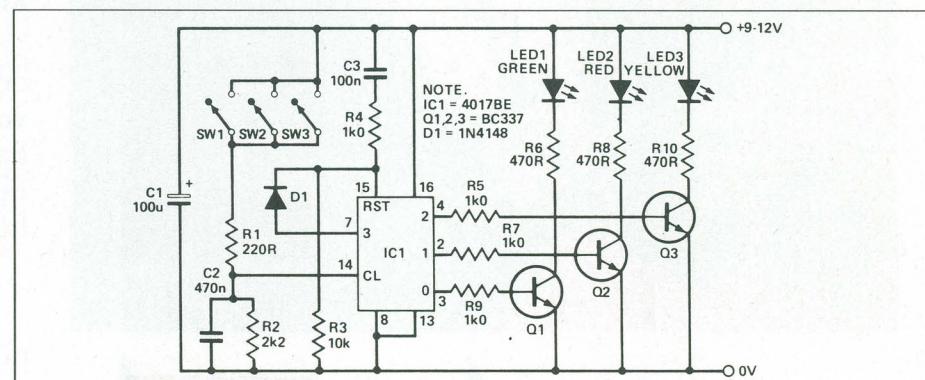
The changeover switch is slightly non-standard in that it is springloaded to a central off position, so that ordinarily it does not supply power to either solenoid. This is an important point, as the solenoid currents are quite high. Applying power for more than a second or two risks burning the solenoid out. These switches are not always totally reliable in operation and the addition of a simple capacitive discharge circuit improves this and totally removes the risk of applying excessive power to the solenoids in an attempt to force operation.

In this switch controller circuit the input supply is fed to a high value capacitor C1 by way of current limiting

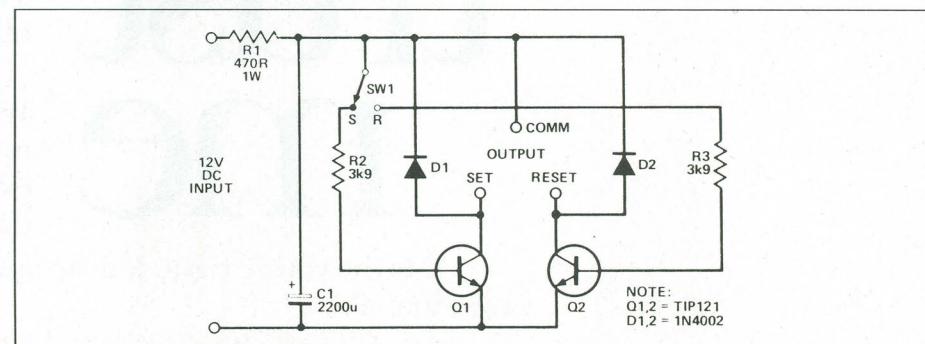
resistor R1. R1 keeps the current at no more than about 25mA, which should be well short of the current need to drive the switch from one setting to the other. This does not matter though, because C1 will charge to virtually the full input supply voltage, and can supply a large enough burst of current to reliably operate the switches. The extremely low source impedance of a capacitor means that the large pulse of current normally removes any tendency for the points to stick.

The solenoids can simply be driven from across C1 by way of the changeover switch. However, things can be refined a bit further, as in this circuit. The switch selects one of two Darlington power

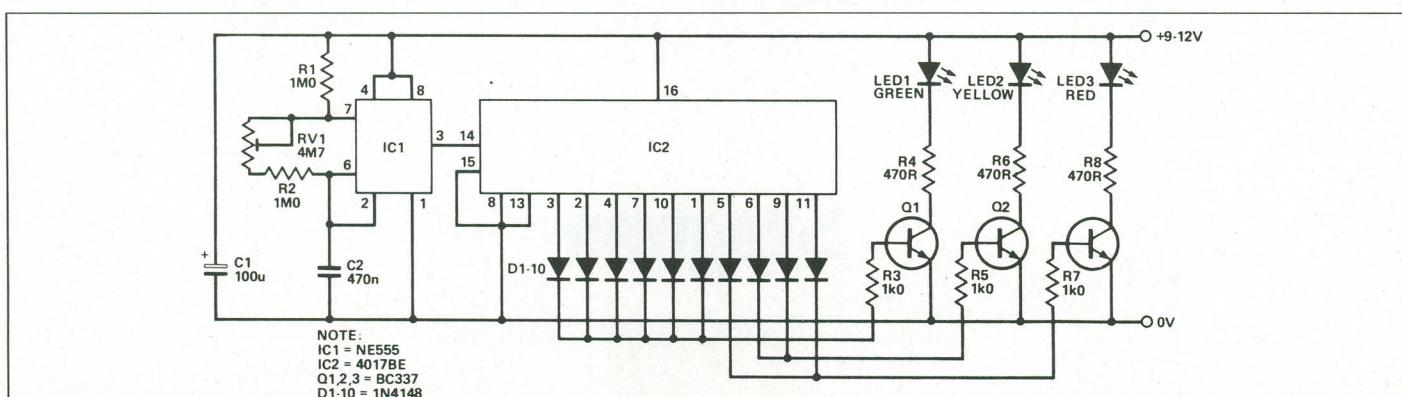
devices (Q1 or Q2) which control the solenoids. R2 and R3 limit the base currents and result in the switch only handling very small currents. This eliminates any problems with contact sparking reducing the operation life of the switch. A miniature toggle type which is springloaded to a central off position is perfectly suitable for SW1. D1 and D2 protect Q1 and Q2 against any high reverse voltage spikes generated across the solenoids as they are switched off. Q1 and Q2 do not require heatsinks. Also note that it takes a second or so for C1 to recharge after the unit has been used and that the controller cannot function until C1 has almost fully recharged. ■



Circuit diagram for three colour signal.

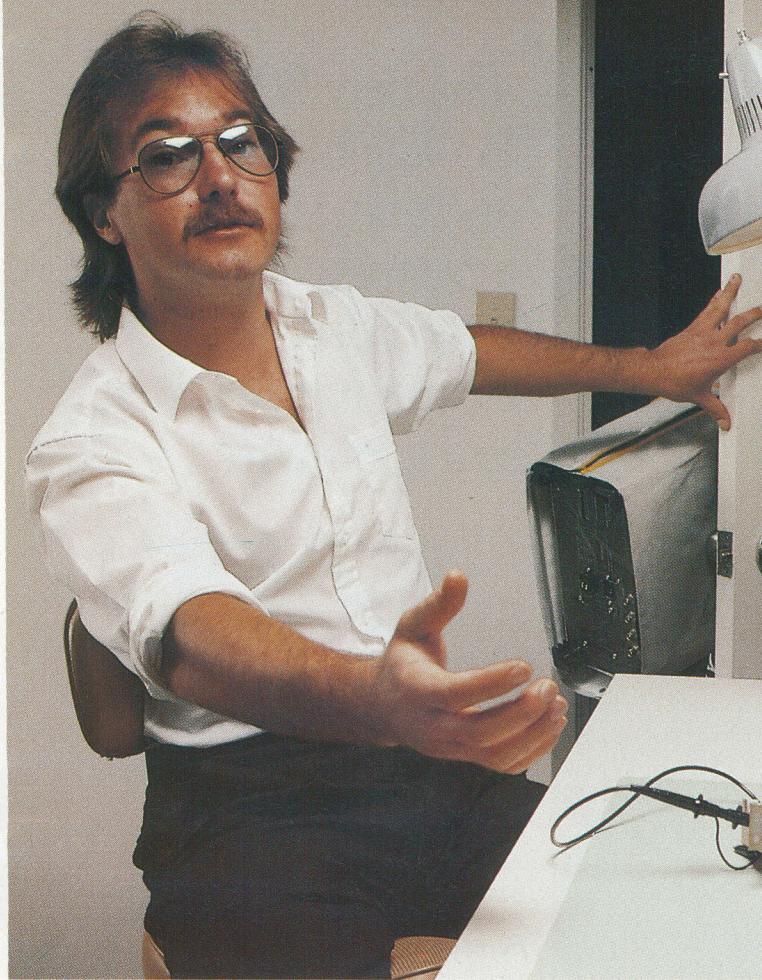


Circuit diagram for the switch controller.



Circuit diagram for cycling three colour signal.

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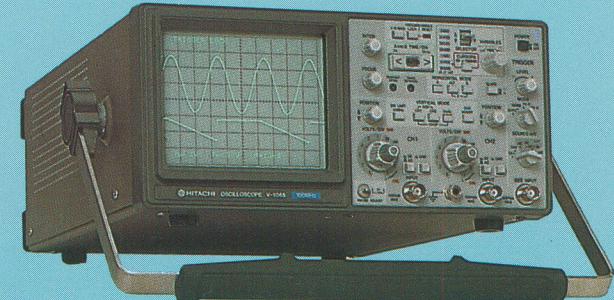
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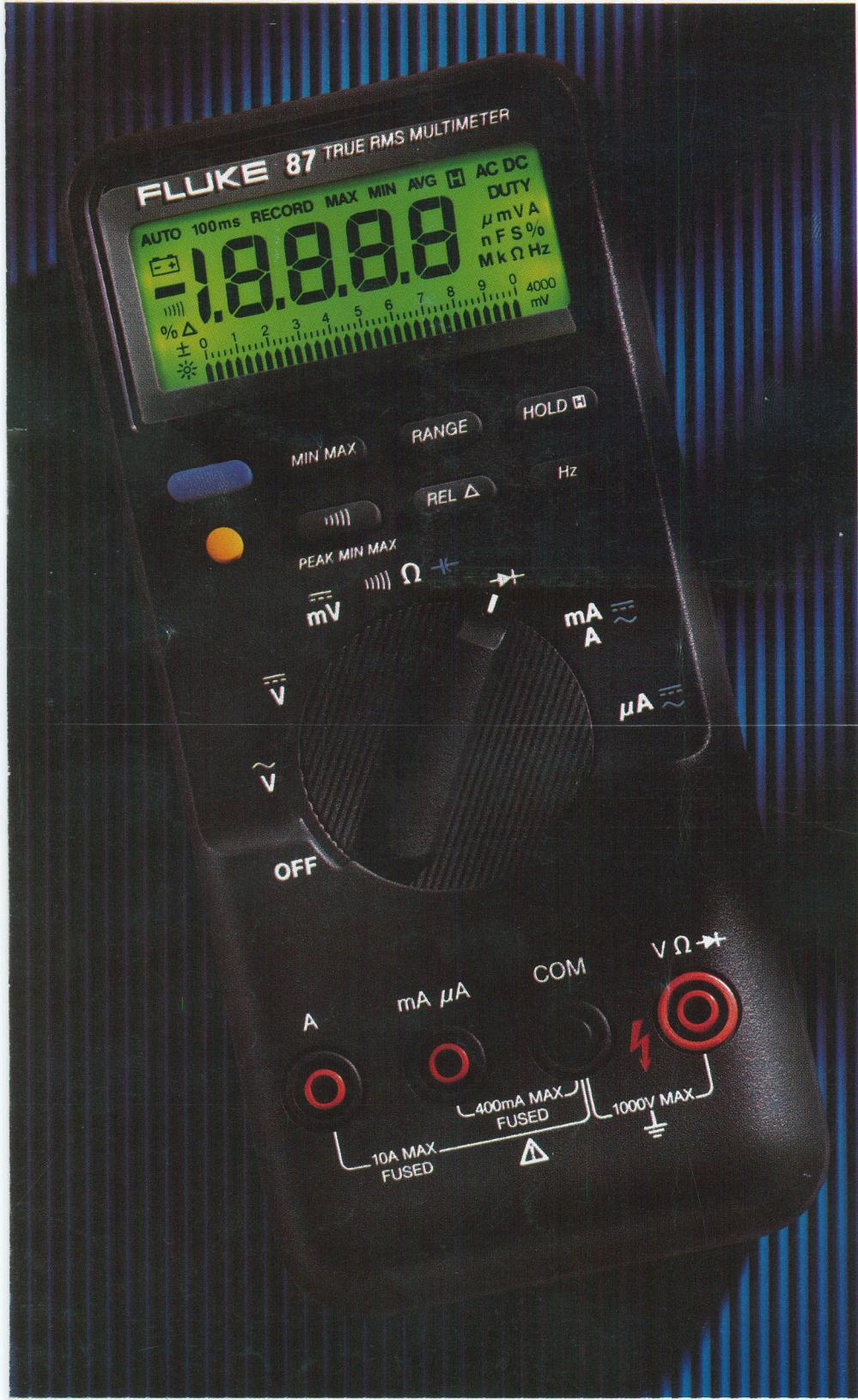
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